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OCTOBER 1953

THE SCIENCE TEACHER

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JOURNAL OF THE NATIONAL SCIENCE TEACHERS ASSOCIATION

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1853/1953 INTO A NEW CENTURY OF OPTICAL PROGRESS
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Please mention THE SCIENCE TEACHER when you write.

THIS MONTH'S COVER . . . pictures a scene at the Port Jefferson, New York, Elementary Science Exhibit. The complete report of this activity was submitted by Flora Kahme, in the 1953 program of Recognition Awards for Science Teachers and was selected as one of twenty-eight entries to receive an award. The interest shown in this working model of a steam engine is representative of the interest shown by all who participated. Photo by Richard A. Spierling.

Readers' Column

Thank you for your invitation to participate in presenting the Science Achievement Awards at Brown High and at North Fulton. With my principal's permission to leave school for these assembly programs, I am happy to accept.

It was fun to see our NSTA office this summer and meet and visit with the staff. Incidentally, I have despaired of getting a bookcase out of my Sustaining membership and the publications keep coming in—so I just up and bought a bookcase on my own!

KATHERINE HERTZKA
Atlanta, Georgia

I was surprised and pleased to come home from vacation in Michigan to find that I had been awarded a prize for my work on Carbon-14. This award is particularly welcome as I had run out of finances for my experimentation, and as you may remember, I planned to build an electronic counter to replace the mechanical counter I was using. The accuracy of my results was limited by the slowness of the mechanical Veeder Root counter. I am definitely planning to continue my education for a career in nuclear science, with a minor in education so that I will be able to qualify as a science teacher.

EDMUND A. RICHARDS
Belleville, Illinois

Thank you sincerely for your invitation to represent NSTA in the presentation of 1953 Science Achievement Awards to the Allentown High School winners. I am deeply grateful to both NSTA and ASM for the Future Scientists of America Foundation and the incentive their Science Achievement Awards have been to the students in our school.

HERBERT H. REICHARD
Allentown, Pennsylvania

Thank you for selecting my entry as worthy of a prize in your contest. One thing I have found very noticeable in connection with high school science is the helping hand always extended by people in science to those who are interested in science. Your giving me this honor is just another example to me of this attitude.

ROBERT DYCUS
Spokane, Washington

Author Answers Critic

In November, 1952, Professor O. H. Browne published "The Problem of the Periodic System" in THE SCIENCE TEACHER. It contained a number of serious misconceptions.

Professor Browne seems to have forgotten the original basis of the Table; namely, similarity of properties. Instead, it is an exercise in theoretical physics. The table separates helium from the inert gases. Such a separation is certainly false. Helium is extremely similar to the inert gases, and it is most dissimilar to the alkaline-earth metals.

Professor Browne's table belittles the question of valency. The table gives no indication of the possible valencies of the elements in families from Number 9 on; and, in addition, suggests that helium has a valency of two!

Two other features of Professor Browne's article should be criticized. His third rule—"There shall be two periods of each length"—is purely arbitrary; no justification is given for it.

The second criticism is more important: Professor Browne states (Point 7) "[The Table] proves . . . that the trans-radium elements constitute a new series of rare earths." This is a piece of loose writing which the science teacher should avoid. The Periodic Table is a summary of certain aspects of chemical knowledge, based on experiment and experience; it can never prove anything. No such summary can be used as a proof. Any proof must be experimental.

In the form of Periodic Table prepared by the Melbourne University Chemistry School, the elements are arranged in ascending order of atomic number. Elements of similar properties are grouped together. This grouping and the form of the table depend on knowledge of the atomic structure.

Thus, the transition elements are grouped as transitional between calcium and gallium. The rare earths are between lanthanum and lutecium, while the likelihood of a similar series of trans-radium elements is in-

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THE SCIENCE TEACHER

The Journal of the National Science Teachers Association, published by the Association, 1201 Sixteenth Street, N. W., Washington 6, D. C. Membership dues, including publications and services, $4 regular; $6 sustaining; $2 student (of each, $1.50 is for Journal subscription). Single copies, 50¢. Published in February, March, April, September, October, and November. Editorial and Executive Offices, 1201 Sixteenth Street, N. W., Washington 6, D. C. Copyright, 1953, by the National Science Teachers Association. Entered as second-class matter at the Post Office at Washington, D. C., under the Act of March 3, 1879. Acceptance for mailing at Special rate of postage provided for in the Act of February 28, 1925, embodied in paragraph (d), Section 34.40 P. L. & R. of 1948.

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Coming . . .

in the November issue of *The Science Teacher*

- Conspiring to Inspire
- Planning Elementary Science Programs
- Metals in World Affairs
- Science Instruction Over Commercial Television

Editor's Column

En route to the Rocky Mountain Regional Conference at Boulder, I have been reminded all over again what a swell bunch of people make up NSTA. I am driving to the Conference and have my family along—all except the oldest girl who is now in "Junior High School" and didn't want to miss two weeks of school. Since we had no vacation last summer, we decided this would be it and arranged for a "leave of absence" for the two elementary school youngsters.

The first night out of Washington we stayed with the John S. Richardsons (Helen and three children) in Columbus, Ohio. Good food and visiting and John and I "talked NSTA" (Advisory Council, facilities study, treasurer's office, etc.) 'til midnight. Three hundred miles and 24 hours later found us at the Herbert S. Zims (Sonia and two fine boys) in Champaign, Illinois. More good food and visiting (the R. Will Burnetts dropped in, too), and again more NSTA talk with Herb and Bill.

Tonight, in Maryville, Kansas, we're all looking forward to Boulder next—to renewing friendships established at previous NSTA conferences—to living in Paul Wilkinson's mountain cabin—and the kids especially, to riding a horse and seeing some calves branded on Stan Brown's ranch. I'm eager for another typical NSTA conference, one carried on in an atmosphere supercharged with sociability and friendliness and one that provides a really solid professional bill of fare. The latter is guaranteed by a program that lists fifty different participants. They come from as widely scattered points as Cincinnati, Ohio (Kenneth Vordenberg), Oak Park, Illinois (Charlotte L. Grant), Grand Forks, North Dakota (J. D. Henderson), Portland, Oregon (Don Stotler), Phoenix, Arizona (Lorenzo Lisonbee), and College Station, Texas (Grady Parker). Some two hundred other science teachers who will be there will also contribute and will go home with new ideas, increased enthusiasm, and a deepened sense of "belonging" to the Association.

I hope you don't mind my telling you what a swell bunch of people NSTA members are.

—o—

Once more it's time to remind everyone that membership fees for the coming year are due and may be paid at any time. If all members would act on this paragraph and send in their dues voluntarily without further notice, they would save the Association more than $400 in printing and postage. Will you cooperate? Just send a note to our membership secretary—Miss Frances A. Keefauver, NSTA, 1201 Sixteenth St., N. W., Washington 6, D. C.—and tell her, "Please continue my NSTA membership during 1954." Enclose check or money order ($4 for regular membership, $6 if you are or wish to become a sustaining member), and sign your name and address *exactly as it now appears on our mailing roll* (unless you definitely wish a change of address). Receipts will be sent promptly after payments are received. Life members will soon receive statements of their accounts.

Robert H. Carleton

THE SCIENCE TEACHER

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The National Science Teachers Association is a department of the National Education Association and an affiliate of the American Association for the Advancement of Science. Established in 1895 as the NEA Department of Science Instruction and later expanded as the American Council of Science Teachers, it merged with the American Science Teachers Association and reorganized in 1944 to form the present Association.

By LYLE W. ASHBY

Dr. Anton J. Carlson, University of Chicago physiologist, once wrote: "The greatest thing in science is the scientific method, controlled and rechecked observations and experiences, recorded with absolute honesty and without fear or favor."

Yes, the goal of the scientist is truth. His weapon is reason. He must be free to inquire, to observe, to challenge, to experiment, to seek the truth.

In a decision of the Supreme Court about ten years ago, Justice Robert H. Jackson wrote, "If there is any fixed star in our constitutional constellation, it is that no official, high or petty, can prescribe what shall be orthodox in politics, nationalism, religion, or other matters of opinion."

I would like to list a few activities in the current American scene which may be tending, whether intentionally or not, to eclipse the fixed star about which Justice Jackson wrote. Some of these activities are not presently directed specifically at the natural sciences. Whether or not they might eventually lead to them is a most important question.

EXAMPLE No. 1. *The effort to ban speakers.* This happens in education. One instance of this occurred about a year ago in Iowa, when a veterans' group tried to prevent the appearance of Dr. Ralph Sockman. That they did not succeed was due to some quick and able action on the part of educational leadership in that state and in Washington, D. C. Why did this group wish to prevent Dr. Sockman's appearance? Because his name was in the files of the House Un-American Activities Committee. Nearly anyone's name, of course, could appear in these files.

Melvin Glasser, now of the Children's Bureau of the Federal Security Agency, who was the executive director of the Midcentury White House Conference on Children and Youth, was scheduled to speak in Texas some months ago. His invitation was withdrawn under pressure. Groups opposed to his appearance said that he stood for the abolishment of segregation in American life. Why did they say this? Because he had served as executive director of a national conference of representative American citizens who, in their final statement of policy, took such a stand.

Pearl Buck has been kept from appearances in Washington, D. C. Ohio State University for a time put a ban on all speakers except on approval by university authorities. These are but a few examples which might be cited.

EXAMPLE No. 2. *Activities of groups which seek to tailor the program of the schools to meet their special demands.* I will cite but two or three examples. First, there is "The National Council for American Education." Note that this is a clever mixture of the names of the National Education Association and the American Council on Education.

The prime mover in this organization is Mr. Allen Zoll. The avowed purpose of Mr. Zoll's organization is "the stimulation of sound education and the eradication of Marxism and collectivism from our schools and national life." He has published such pamphlets as "Progressive Education Increases Delinquency," "How Red Are the Schools?," "Private Education: the Answer to America's Educa-

tional Problem," and "Should America's Professors Be Pro-American."

Another organization which might be mentioned is the "Friends of the Public Schools of America," operated by Major General Amos A. Fries, Retired, in Washington. Mr. Fries has carried on a constant campaign of criticism of the schools with special emphasis on alleged left wing influences.

These are some of the attackers of education in the United States. They are self-appointed and self-organized, either for profit or for the achievement of their own ends through the schools.

One might assume that under ordinary conditions such organizations would make no headway. However, in a time of tension, when fear of communism is abroad in the land, these people succeed by wrapping their bill of goods in religion, the flag, and the fundamentals. They succeed in selling it to many unsuspecting citizens.

That these groups do have some influence is apparent from what has happened in a series of communities from one end of the country to another. Unrest has been developed. Books have been banned and expurgated. Reputable educators have been attacked.

EXAMPLE NO. 3. *The censorship of textbooks and other classroom materials.* The Committee on Education of the so-called Conference of American Small Business Organizations publishes what is known as *The Educational Reviewer*, under the direction of Lucille Cardin Crain. Its purpose is to analyze textbooks used in the schools. This work was launched at a conference in Washington, D. C., under a resolution that read in part: "Left wing educators, known as 'frontier thinkers,' have in recent years sought to reconstruct our educational system with the avowed purpose of bringing about a new social order based upon the principle of collectivism or Marxism. To this end these educators have secured the adoption of textbooks which are essentially documents of propaganda with the aim of changing the 'climate of opinion' in the United States."

In Houston, Texas, for example, Magruder's textbook, *American Government*, has been banned by the Board of Education even though it is generally considered a conservative book.

EXAMPLE NO. 4. *The virus of these groups spreads to more reputable groups.* Respectable agencies are taken in by the cry of communism in the schools. For example, in June 1952, the *American Legion Magazine* carried an article by a Mrs. Irene Kuhn entitled "Your Child Is Their Target." The entire article is a vicious attack on the American education system and the nation's teachers. Mrs. Kuhn says that educators are trying to indoctrinate, "to destroy individualism and to produce unquestioning robots." The article promotes the un-American doctrines of guilt by association, thought control, and the idea that the accused is guilty until proved innocent. It is apparent that the writer relied heavily on material circulated by groups operating nationally to promote dissension and lack of confidence in the public schools, such as those we have just described.

To the credit of the American Legion as an organization, it passed resolutions in August 1952 in which it expressed pride in the achievement of our public schools and condemned the originators of subversive attacks upon them. Furthermore, the officers of the American Legion have now expressed a willingness to publish an article favorable to the public schools and the NEA.

In June 1951, the American Medical Association passed a resolution which read in part: "Whereas, many of our educators and many of the organizations to which they belong have for many years conducted an active, aggressive campaign to indoctrinate their students in grammar school, high school and college with the insidious and destructive tenets of the welfare state, this teaching of hatred and scorn for the American system of private enterprise having been so widespread and successful that as a result our voters are conditioned to accept all manner of totalitarian expedients in direct violation of economic law. . . ."

Here again, after protests from the NEA, which has had a Joint Committee with the American Medical Association for about thirty years, the *Journal of the American Medical Association* carried an editorial stating that the AMA did not intend a blanket indictment of all of our schools and teachers and a much kinder resolution was adopted in 1952 by the AMA. The fact that such materials find their way into the resolutions and magazines of such staunchly American organizations indicates the extent to which fear, suspicion, and distrust of the schools are being sown so cleverly by enemies of the schools that even our friends are "taken in."

EXAMPLE NO. 5. *Loyalty oaths for teachers.* There has been a wave of activity in this field—another evidence of fear and suspicion concerning our educational system. Such oaths lead inevitably to investigations, secret or otherwise, and arouse suspicion and turmoil.

As Professor Ernst H. Kantorowicz, a political refugee from Nazi Germany and a distinguished historian, has said: "This is the way it always begins. The first oath is so gentle you can scarcely find anything at which to take exception. The next

This article is a condensation of Dr. Lyle Ashby's address delivered at a general session of the Pittsburgh convention of NSTA last March 21. It presents a reasoned and documented analysis of the question through a survey of some of the threats to the freedom to read and the freedom to learn and of the attacks on schools and teachers in our country today. Dr. Ashby concludes, "Make no mistake about it. The greatest thing in science (the scientific method) *is* in danger." He does not stop here, however, but suggests a number of actions by which teachers, scientists, and other intelligent, well-meaning citizens can "take the lead" in correcting the situation. In this connection, we urge you to read if you have not already done so, "A Victory for Every Teacher!" in the October issue of the *NEA Journal,* p. 397.

A native of Nebraska and formerly a teacher of the social studies in high schools in that State, Dr. Ashby is NEA Assistant Secretary for Professional Relations, a position he has held for seven years. He is in charge of the NEA Centennial Action Program and is chairman of planning for the NEA conference on instructional problems to be held in Minneapolis next mid-April.

oath is stronger." The practice of singling out teachers for oaths and declarations is not only obnoxious but ineffective. The subversive will sign the oath with no trouble to his conscience.

Concurring in the majority opinion on an Oklahoma oath statute, Justice Black said: "The Oklahoma oath statute is but one manifestation of a national network of laws aimed at coercing and controlling the minds of men. Test oaths are notorious tools of tyranny. When used to shackle the mind they are, or at least they should be, unspeakably odious to a free people."

EXAMPLE NO. 6. *Certain newspapers, commentators, and columnists are making the most of these times.* The position of the Hearst press is too well known to require any documentation. Among the commentators, Fulton Lewis, Jr., recently said in a broadcast, in substance, that parents who send their children to the public schools must shudder at the prospect of having their children under the influence of left wing teachers. When one communist is found, that, of course, is news and the impression the casual reader or listener gets from the day's news is that the schools must be very red indeed.

EXAMPLE NO. 7. *Attacks on UNESCO and the UN.* These attacks have been made in many quarters. A UNESCO program in Los Angeles has been under attack. In one Florida city there was a furor because the annual report of the school system carried a picture of the globe on one of the inside pages. Attacks on UNESCO have been numerous from coast to coast.

EXAMPLE NO. 8. *Congressional investigations of education.* In June 1949 the House Un-American Activities Committee caused a spectacular bit of publicity by a letter which it sent to many college presidents requesting that they submit a list of textbooks used in their history, economics, and political science courses. This request was withdrawn as a result of the storm of criticism from educators and the press.

Last fall there were indications of an investigation of education and research foundations conducted a year ago by a committee under the late Representative Eugene Cox of Georgia. This investigation revealed considerable information on the function of foundations in America but not on subversiveness. The real effect of this investigation will be its influence upon foundations during the next 25 years. Will they hesitate to support liberal or experimental projects for fear of being called to account, just as the Ford Foundation was recently criticized for its projected inquiry into restrictions on freedom?

In September, 1952, the Senate Internal Security Subcommittee, then under the direction of Senator Pat McCarran of Nevada, questioned members of the Teachers Union in New York City. This group had previously been investigated by the Rapp-Coudert state legislative investigation.

The business of investigating education did not really blossom, however, until the present 83rd Congress. Within the first month of its existence more than one hundred legislative proposals for investigations were introduced into the House and the Senate.

Mrs. Bella Dodd, perhaps the best informed of the reformed communists, who testified before the Senate Internal Security Subcommittee, reported that at their greatest strength in the early 1940's she could not estimate that there were more than 1500 communist teachers in the United States out of more than a million members of the profession. Out of this number or any other estimate a very small number have been proved disloyal. Thus, the investigations may prove wholesome in one respect. They will show how few communists there are in the teaching profession rather than how many.

EXAMPLE NO. 9. *The search for subversives in government and in science.* The general Federal Government loyalty program is too well known to require discussion of it. There were reasons for it and there were dangers in it.

Scientific development in our day is literally the means of self-protection. Approximately 35,000

specialists are now employed by our government agencies. Many thousands of others are employed by universities and industries in projects actually supported by the federal government. Thus, as Kirtley Mather pointed out at the recent meeting of the American Association for the Advancement of Science, while the government is dependent upon the scientist, many scientists are dependent upon the politician.

The Internal Security Act of 1950 and the McCarran-Walter Immigration Act of 1952 have both had a widespread impact upon science. Both were passed by Congress over the veto of President Truman. They have dropped what has been termed a "red tape curtain" around the United States. Travel has been restricted and international gatherings of scientists greatly curtailed.

We have been faced with a paradox. As Alan Barth has so well said: "When men possess weapons that can obliterate whole communities in the flash of an explosion, pre-eminence in science is an indispensable condition of national security. At the same time, freedom is an indispensable condition of scientific pre-eminence."

I shall not enter into the relative merits of the arguments for and against "security by concealment" versus "security by achievement." J. Robert Oppenheimer once said that: "the gossip of scientists who get together is the life-blood of physicists." Out of such informal talk come criticism, new insights, new facts, testing of preconceptions. In the long run and to the extent that we can have "security by achievement," science will march forward more rapidly than it can ever do under the wraps of secrecy, even granting that some secrecy at certain points may be essential.

We have now cited some of the conditions which exist in American life. We know that science is already affected. How much more can it be affected? Is our freedom in America in danger? Is the greatest thing in science in danger? The answer to this question is very clear. It is yes. This is not to say that our country is in imminent danger of dictatorship. It is time to be on guard and to try to understand the meaning of what is happening.

The teaching profession, of course, has clearly registered its opinion regarding the undesirability of communists in Education. For example, several years ago, the bylaws of the National Education Association were revised to state that "no person shall be admitted or continued in membership in the NEA who advocates or who is a member of the Communist Party in the United States or of any organization that advocates changing the form of government of the United States by any means not provided for in the Constitution of the United States." Furthermore, the platform and resolutions of the NEA clearly state that communists should not teach in American schools; but they do make it clear that the schools must teach *about* communism which is very different from advocating communism. In 1953 the NEA by resolution declared that it "recognizes the right of legislative bodies to conduct investigations directed toward prospective legislation. Educators called upon to testify in such investigations should do so fully and frankly."

The evidence we have cited represents a number of things in American life. Much of it may represent real fear. Perhaps this is understandable in a world of tension. Much of it is deliberately built on the fear motive to accomplish other objectives. Much of it represents pseudo-patriotism It is not the kind of patriotism that our Revolutionary forefathers had. Much of it represents a demand for conformity. What those who attack the schools, for example, really want to do is to restrict rather than expand the minds of pupils. Much of this evidence represents intolerance in American life. Yet our country's great development came because it was the melting pot of the peoples and ideas of the world. This evidence definitely represents some loss of freedom in America, including the right to make mistakes. This is inevitable when fear grows in the hearts of people. Much of this evidence represents suspicion of other people. It is the story of vast numbers of people spying upon each other, either officially or unofficially. This is the kind of thing that flourishes on a widespread scale in a dictatorship.

Of course, the beginnings of the loss of freedom are very gradual. It is like erosion in the soil. Charles Morgan, in his book, *Liberties of the Mind*, devotes his introduction to the problem of "Mind Control." He cites the views of a psychiatrist friend of his as follows: "We are all being conditioned to accept a limitation of freedom, even some of our mental freedom. Some are unaware of it and some try consciously to resist. But I fear that, unconsciously, even we are ready to accept this new infection which would not have harmed us prior to 1939. There is no such immunity in the great mass of our people and no consciousness or danger. They lap up the virus as though it were milk."

Have we been affected by the trend of the times in our schools and colleges? The answer is definitely yes. There have been the loyalty oaths, the textbook investigations, and the criticisms of the public schools. All of these evidences of attempts

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Materials for a Contemporary Science Problem:

FLUORIDATION OF PUBLIC WATER SUPPLIES

By LOUIS F. VOGEL

Not quite a case of "man bites dog," but here is a helpful and provocative article written by an editor. Mr. Vogel is a science textbook editor for D. C. Heath and Company. Naturally he's interested in finding better ways to make science instruction more effective. As indicated by this article, Mr. Vogel approves of the "problem approach." However, he argues that this is not easy; that a thorough-going, both-sides-of-the-question inquiry into a contemporary science problem requires more than an ordinary amount of participation by the teacher. But he does show that *it can be done*. Moreover, he lists several sources of help for the science problem under discussion.

Mr. Vogel's editorial work was preceded by ten years of successful science teaching in elementary, junior high, and senior high schools. Right now in his spare time he is busy working to add a Boston University Ph. D. after his name.

As SCIENCE TEACHERS, you are often berated for not using the wealth of current materials that illustrate the impact of science on society. You are told that it is your job to help prepare citizens who can cope with the problems that science creates. You may heartily agree that students should be aware of current science problems and should know how to cope with them, but your good intention to do something about it will probably come to nothing. After all, what is a contemporary science problem? Where are the current materials and how can one obtain them?

The fluoridation of public water supplies is an ideal topic for study. To proponents and opponents fluoridation means the addition of some fluoride, such as sodium fluoride, to raise the ratio of fluoride to water to approximately one part per million for the purpose of reducing dental caries in children up to 10 years of age. The problem has a universal and personal appeal. Millions drink public water. Fluoridation is a topic on which there is disagreement all the way from the basic science to the methods of application. The controversy on fluoridation dramatizes the complexity of modern society, because the problem touches the areas of science (particularly biochemistry), law, the principles of democracy, government, religion, medicine, dentistry, and ethics. The problem originates in science, but it has meaning for many subject teachers in different courses in high school. Chemistry, biology, general science, social studies, mathematics, civics, English (debating, journalism communication, semantics), and history are related to the problem. Finally, it is a problem on which most future citizens can act. Approximately 600 communities have accepted fluoridation, but there are approximately 16,750 public water supplies providing 100,000,000 people with water. In many communities the issue is put to a vote where the voter can express his opinion, Yes or No. Other ways individuals or groups can forcefully express convictions are through letters to the editors of newspapers, letters to government officials, articles in magazines, articles in school papers, and debates before the public. Such means are available to high school and college students as well as to adults of voting age.

Gathering materials for a study of such a problem is not a simple matter. No bibliography of materials has been published, even at the level of scientific research. No publisher has gathered articles representative of the controversy in a convenient pamphlet or book. My own experience is that there is a great volume of mimeographed or printed material, but that it takes time, persistent effort, and some money to make a useful collection. I have a foot-high pile of material on my desk, collected over a period of two months, weighing about 10 pounds, and representing a cost of about $7.50. How much of it would be of value to a science teacher?

Proponents

The best collection of materials giving the point of view of those in favor of fluoridation is put out as a kit by the American Dental Association (1).

One copy of this kit, consisting of a folder containing printed and mimeographed materials, may probably be obtained without charge. Additional copies are sold at $1.00 each. The folder contains reprints of articles in the *Journal of the American Dental Association,* which describe the history and development of scientific research on fluoridation and in particular a summary of results to date in the controlled experiment in the cities of Newburgh and Kingston, N. Y. The pamphlet *Fluoridation in the Prevention of Dental Caries* is also useful, but is in the process of revision. The indexed material in *Facts Regarding Statements Made in Objection to Fluoridation* summarizes the "assertions" of the opposition and presents the "facts." The *Resources for Information and Visual Materials on Fluoridation* lists five one-reel sound films in color which may be rented for $2.50 on a two-day basis. Also listed are 20 slides in color and black and white, which may be rented for $1.50 a day. Two exhibits are also available. The costs of reprints in quantity are given. In addition to this kit the American Dental Association publishes other materials. The *Information Bulletin* for May 1952 is interesting for its map of the United States showing the fluoride content in analyzed water supplies.

Another kit or folder of mimeographed and printed materials is distributed by the New York State Department of Public Health (2). Much of the material relates to community experience with fluoridation in New York State. Some materials, however, like the *Report of the Ad Hoc Committee on Fluoridation of Water Supplies* published by the National Research Council and the pamphlet *Better Health for 5 to 14 Cents a Year through Fluoridated Water* published by the Federal Security Agency give a national point of view.

Materials which dramatize the necessity for public education on this subject may be obtained from the San Diego, California, Department of Public Health (3). The legal aspects of fluoridation are particularly interesting in the *Memorandum Opinion on the Motion for Nonsuit* by Dean Sherry, Judge of the Superior Court of California.

The best single volume to give the instructor a secure background in this study is *Dental Caries and Fluorine* edited by Forest Day Moulton and published by the AAAS (4).

An excellent mimeographed tabulation of communities already using fluoridation and of those considering it in North America has been prepared

by the City Health Department, Charlotte, North Carolina (5).

Opponents

After reading the materials supporting the fluoridation of public water supplies, you might get the idea that the opposition consists of a small minority of crackpots. A search of the literature published by the opponents reveals that this assumption is not a fair one. Many of the people opposing this measure are scientists, doctors, dentists, legislators, and heads of large organizations.

Many interesting pamphlets, reprints of articles, and photostats of letters to editors have been collected in a folder by Dr. Charles T. Betts, President of the Anti-Cancer Club of America (6). This folder is offered for sale for $3.00 and includes a number of articles and pamphlets. Dr. Gustav William Rapp in his article *The Pharmacology of Fluoride* questions the validity of the premise that adding sodium fluoride to ordinary domestic waters produces the same aqueous environment for teeth as is found in the endemic areas in the country. Dr. George A. Swendiman in his article *The Argument against Fluoridating City Water* attacks the measure on the grounds of inadequate experimentation and governmental intervention in health matters. Dr. Royal Lee (7) in *Fluorine and Dental Caries* doubts that the biochemical principles involved in the relationships between fluorine in food and water and tooth decay are understood. These and other articles, together with the House of Representatives, 82nd Congress, Union Calendar No. 787, Report No. 2500, *Report on Fluoridation of Public Drinking Water* and the "Extension of Remarks of the Hon. A. L. Miller of Nebraska" in the March 24, 1952, issue of the *Congressional Record*, summarize the principal arguments against fluoridation.

The *Anti-Fluoridation Data*, consisting of 188 mimeographed pages of materials compiled from newspapers, letters to editors, magazines, letters, speeches, textbooks, and professional articles, compiled by the International Chiropractors Association (8), gives a detailed picture of the opposition. Letters to the editors of newspapers throughout the country, not easily collected by an individual, are particularly interesting as opinions of persons who exert influence in their communities. This collection of material is broader than that of Dr. Betts, although in some instances not all of the material in an article is quoted. However, there is no charge for the *Anti-Fluoridation Data*.

While there are many other papers which should be mentioned in a complete bibliography, the purpose here is to stress those readily available. One paper, *An Examination of the Scientific Basis for Fluoridating Populations*, by Dr. V. O. Hurme (9), reprinted from *Dental Items of Interest*, June 1952, is worth special comment. Dr. Hurme questions the advisability of adding fluorides to drinking water from the viewpoints of nutrition toxicology and the scientific basis for its recommendation.

Conclusion

Fluoridating public water supplies is a contemporary problem originating in dental science with meaning for many divisions of our complex society. The problem cuts across the subject matter divisions in high school and represents one on which many students as future citizens can take action. The materials for this study are readily available at small cost. The effectiveness of this problem as a teaching unit depends, as always, upon the teacher. Following are addresses, organizations, or persons from whom materials can be obtained.

1. American Dental Association
   Order Department
   222 East Superior Street
   Chicago 11, Illinois

2. State Department of Health
   Bureau of Dental Health
   Albany 7, New York

3. County of San Diego
   Department of Public Health
   Civic Center
   San Diego 1, California

4. American Association for the Advancement of Science
   1515 Massachusetts Avenue, N.W.
   Washington 5, D. C.

5. Division of Dental Health
   City Health Department
   Charlotte, North Carolina

6. Dr. Charles T. Betts, *President*
   Anti-Cancer Club of America
   332 Superior Street
   Toledo, Ohio

7. Lee Foundation for Nutritional Research
   Milwaukee 3, Wisconsin

8. Committee on Research
   International Chiropractor's Association
   838 Brady Street
   Davenport, Iowa

9. Dr. V. O. Hurme
   Forsyth Dental Infirmary for Children
   Boston, Massachusetts

TEN THOUSAND YEAR OLD CLASSROOM

By KARL BENTON COMPTON

North Texas State College, Denton, Texas

ONE DAY IN JANUARY a farmer boy was walking across one of the pastures of the family farm some five miles south of the city of Denton, Texas, when, from the bank of a deeply eroded gully, he noticed what looked to him to be large bones protruding. He examined these bones with some curiosity and at the first opportunity he mentioned them to his neighbor, Professor Compton, whom he knew to be interested in archaeology. This was the start of a period of activity which resulted in an educational experiment of some considerable extent, for Compton was a teacher at North Texas State College, an institution in which education and teaching are very important areas of concentration.

The bones which the boy had noticed proved to be those of a Pleistocene elephant. After consultation with noted archaeologists in the Southwest, it was decided that a group of students and faculty members from various college departments would excavate the remains, under Compton's direction, to determine, if possible, whether or not this mammoth had been a victim of the spears of early man in the region. This cooperative educational endeavor was but the start of a widespread exploitation of the site for educational purposes.

Fortunately, erosion had exposed a good quantity of bone and had removed tons of overburden from the site, making digging and early exposure of important and interesting items relatively easy and quick. A huge tusk measuring nine feet two inches in length was first exposed and on February 11, 1953 a lengthy front-page article with photographs appeared in the local newspaper. Although those in charge of the affair had been prepared for public interest in the dig, the response was surprising even to them. The public was asked in the article to visit the dig only at a specified time; their courtesy in observing this request was remarkable and a great tribute to the thoughtfulness of people in general. No vandalism occurred throughout the dig and, although hordes of people visited the site, no damage of any sort was done to the bones or the site.

When enough of the bones had been exposed to make the excavation both interesting and informative, the Television news service in the region was contacted. The station sent its cameraman to the site and made two telecasts of the dig, informative charts, and other items of interest. Following this, a full fifteen-minute TV show was prepared by the excavating group and was televised from another leading TV station in the region. At all times the emphasis was upon the educational elements of the excavation: the migrations of animals, the coming of man to the Americas, the importance of knowing about the past, the inter-relations of the arts and sciences, and the like.

General view of excavation at an early stage

While the television angles were being exploited, interest in the mammoth on the part of the public and, more importantly, on the part of teachers in science classes in the public schools, was growing by leaps and bounds. The director of the project was bombarded by requests from teachers that their classes be allowed to visit the site. This was exactly the reaction desired, and the director invariably arranged to meet such classes and to discuss the dig and the mammoth at length. High school and junior high school classes in numbers as large as one hundred fifty pupils visited the site, coming in school busses from towns and cities many miles

distant. To each of these parties, a trench lecture was given by the director of the excavation, stressing the various educational angles involved. In addition, groups of people not connected directly with schools were likewise given information in a similar manner. It is estimated that about three thousand persons visited the site before the excavators began to remove any of the skeletal material.

While the skeletons of Pleistocene elephants are not particularly rare, it is rather surprising how few of them have been scientifically excavated and it is even more surprising how little educational use has been made of the public interest in such anthropological activity. Sensing that a need existed for certain teaching devices which could exploit the educative value of an archaeological excavation of this sort, Director Compton and Dr. Elgin Williams of the NSTC Sociology Department, decided to make a series of color slides, color filmstrips, and 16-mm motion picture films which might be used as teaching material, these ultimately to be expanded, if possible, into a whole series showing acculturation in the Americas. Many difficulties were encountered in the first trial slides and strips but largely owing to the perseverence and willingness to experiment on the part of the people concerned, and thanks in no small part to the assumption of the financial burden by Dr. Williams, the first of a set of slides, strips, and films were made. These are undergoing field-testing by being used in classes on various levels, to determine the exact content and composition most desirable for optimum educational value.

All of the foregoing activity was additional to the actual archaeological practices chiefly of interest to the professional or quasi-professional anthropologists to whom the more technical data were and will continue to be sent. What is here intended to be shown is the educational possibilities inherent in such more or less professionally scientific pursuits and which have heretofore been largely neglected. While it is undoubtedly true that such educational endeavor takes a toll of the investigator's time, it is very probable that the investment of this time in such "public relations" would rather shortly pay the anthropologists at large great dividends in heightened interest and therefore heightened support of their activities.

A college class in anthropology at the site

A sixth-grade class from a local school visits the mammoth dig.

Lest the attitude that "we can't all excavate a mammoth" inject a discouraging note into the matter, it should be hurriedly remarked that there are few spots in the Americas, outside of the larger cities, where evidences of early man are not to be found. The press is constantly reporting important archaeological and paleontological finds by intelligent and informed amateurs. It should be remembered that the first bone of Folsom man ever to be encountered was recently discovered by a postmaster-archaeologist in New Mexico and the most complete fragment of the ancient Miomastodon was discovered, by curious coincidence, by a postman-antiquity-collector.

Perhaps the most important elements to be demonstrated here are that the classroom-on-the-site is a powerful stimulation to retention by the pupil of material regarding acculturation which may be presented to him, and that such opportunities for the exploitation of such sites are by no means rare or difficult to discover. By utilizing the natural curiosity of people about anything strange or different, we may lead easily into the dissemination of information and inculcation of attitudes that we desire. Children as well as adults will listen with intense interest to informative ma-

Tusk of Parelephos Columbi

terial while "viewing the remains", so to speak, when they would turn away in boredom from the same material presented under different circumstances. And the child who has recently found a "real Indian arrowhead" will take a proprietary interest in the activities of those who populated the Americas long before the land of Columbus or that of Cabot were powers upon the earth.

Aside from having his ten-thousand-year-old resting place used as a classroom and laboratory, our mammoth has still a continuing educational function. Manifestly, the bones could not be left indefinitely in their out-door pit, at the mercy of the elements and erosion. Moreover, in the careful search of the site for possible evidences that he was the victim of Pleistocene man searching for food, it was necessary to remove the bones and examine all of the surrounding soil for artifacts. Therefore, we carefully removed sections which seemed to be most interesting and, in the course of time, these will be placed in an exhibit in an anthropological museum at the College, together with photographs of the progress of the excavation, drawings of the mammoth as he looked when alive, skeleton charts, and other items of educational interest and value which relate to the mammoth. Thus, we hope, generations of students may be interested in their country's remote past through intimate contact with the bones of one of its more spectacular inhabitants. It may be that this mammoth whose flesh once perhaps fed the bodies of Clovis man may continue to feed the imagination and spirit of modern man.

FRANKLY FACING TEMPERATURES

By RAUS M. HANSON

Madison College, Harrisonburg, Virginia

EACH PERSON MAY BE AWARE of one element of the climate at any time. He may be considering only the sunshine, only the wind, or only the temperature. He may fail, also, to bring these and other elements together in a complete pattern. Within the United States, there are only a few places where man has regularly kept records of daily temperatures for as long as 100 years. Beginning about 1870, an increasing number of places have complete temperature records.

The maximum and the minimum temperature of each day is now published regularly in many communities having a daily newspaper. Generally, neither the average temperature of each day nor of each week are mentioned in the newspaper accounts regarding the weather. The lack of statements regarding average temperatures may contribute to incorrect viewpoints regarding the community's temperatures. A summary of conclusions from these daily records has too rarely been furnished to the newspaper for wider publicity.

Temperature is one atmospheric element from the list including winds, sunshine, rainfall, and others. It can be used, however, as an illustration of how daily records may supply a more nearly complete pattern of a community's climate.

Some persons are confident that their community has both more hot and more cold days than may be supported by official records. Others are confident that there are as many cold days each year as there are hot days. Those persons seem to lack a recognized dividing line between temperatures such as hot and warm, warm and cool, and cool and cold. This lack, no doubt, causes a part of their difficulty.

A practice in using recognized dividing lines for temperature divisions on charts when teaching a locality's climate began more than 25 years ago. With that plan, a month is labelled *hot* if its average temperature is above 68° F. The label *warm* is given to a month having an average temperature between 50° and 68°. The word, *cool,* is used in labelling months having average temperatures between 32° and 50°. *Cold* becomes the label for months having average temperatures below 32°.

The explanation of the practice makes it evident that each division's label applies to temperatures having a difference of 18 degrees. Based on the often used plan of 18 degrees distinguishing each group's temperatures, other divisions may be made. A division line below freezing, then, may be drawn at 14° F. and the label *very cold* is used for average temperatures between 14° and –4°. A division line at –4 is drawn and the label *frigid* is placed below that line. *Frigid* labels the division having average temperatures below –4°. By adding 18 to 68°, a division at 86° is located and average temperatures above that line may be labelled *very hot.*

A day's mean temperature is the temperature midway between the highest and the lowest temperatures for that selected day. A person knows the highest and the lowest temperature for a day at a given station. Then, he may find the day's mean temperature by finding half of the sum of the highest and the lowest. Next, a plan similar to the one used for labelling months may be used for separating mean daily temperatures into the same seven divisions. A day with a mean temperature of 62 would be a warm day. However, a day with a mean temperature of 69 would be in the division of hot days.

The weather records of Madison College can be used to apply the ideas presented in the preceding paragraphs. During ten calendar years, 1942-51, the maximum and the minimum temperatures have been recorded daily on the Madison campus. The ten years had 3652 days. When the mean temperature for each of those days had been tabulated, there had been 904 hot days, 1260 warm days, 1033 cool, 429 cold, and 26 very cold. In percentages, there had been 24.75% hot days 34.50% warm, 28.29% cool, 11.75% cold, and 0.71% very cold. A graph (Figure 1) shows the distribution of the 3652 days of the ten years. The graph gives emphasis to the fact that the ten years had only 455 cold and very cold days compared to 904 hot days.

Many persons, highly trained in other subjects but not having had any training in meteorology, may have difficulty with organized weather records.

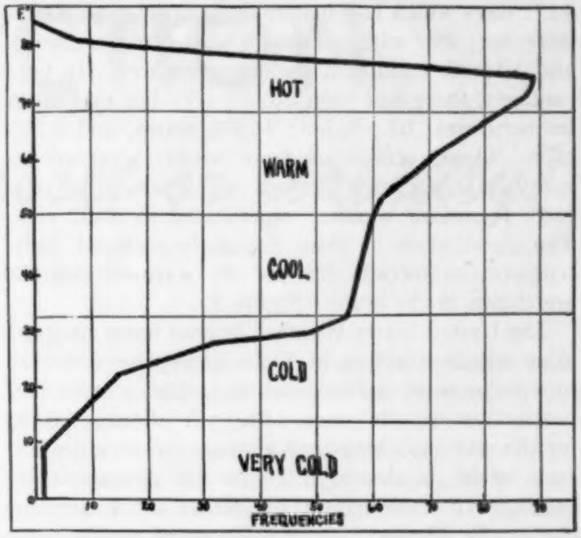

Figure 1—Graph showing frequency in number of days having each average temperature during ten years on Madison College campus, Harrisonburg.

These persons often express surprise that a major consideration is given to the importance of mean temperatures of both days and months. One of these persons may remark: "The thermometer on the north side of my house read 104; I remember that was a hot day." The remark lacks any suggestion that the minimum temperature during the following night needs to be considered when speaking of a day's temperature.

Many Harrisonburg residents have lived continuously in the city during the ten years, 1942-51. However, they find difficulties in accepting the information regarding the limited number of cold and very cold days during the ten years. They consider that chilly days are cold. They are confident that the number of cold days should be almost as many as the number of hot days. Besides, their remarks show that they rarely think of mean temperatures. Instead, those persons measure hot days by the highest temperature reading of the day.

The six calendar months beginning with May and continuing through October have the highest average temperatures in this Virginia city. The Madison College records of the maximum temperatures for each day in the six warmest and hottest months were used for the next part of this study. There are 184 days in the six months. The tabulation of each of those daily maximum temperatures in the ten calendar years was made. From the records of the 1840 days, there are 380 days with maximum temperatures above 86, which placed them in the very hot days. The records showed

1151 days which had maximum temperatures which were hot; 299 with maximum warm temperatures; and 10 with maximum cool temperatures. In percentages, there had been 20.6% very hot maximum temperatures; 62.6% hot; 16.3% warm; and 0.5% cool. These records are more readily accepted by many Harrisonburg persons as representing the facts regarding weather experienced in their city. The distribution of these popularly-accepted daily temperature records for the six warmest months are shown in the graph (Figure 2).

The United States Weather Bureau has a co-operative weather station at Dale Enterprise which is four miles west of Harrisonburg. This station has continuous records since 1880. A climatic chart for the stations's long-time average temperature for each month is shown in Figure 3. Average temperatures of whole months are shown in the climatic chart. In Figure 2, temperatures of single days from the six warmest and hottest months were used. That explains why the chart in Figure 3 gives an impression of a smaller percentage of hot days than is shown on Figures 1 and 2.

The United States Weather Bureau maintains a weather station within 25 or 30 miles of nearly every high school. The person in charge of a co-operative weather station is known as the observer. That person gives only a few minutes each day to observing and recording the day's weather. The observer of a co-operative weather station is not paid a salary, therefore, he should not be asked to supply a copy of the records. However, the records may be copied by any interested citizen who plans to use them either for study or for comparisons. The Madison College records have been used as an illustration of how such records may be considered. Teachers of mathematics, physics, and geography in any community can easily make a similar study of records from ten or more years for a nearby weather station.

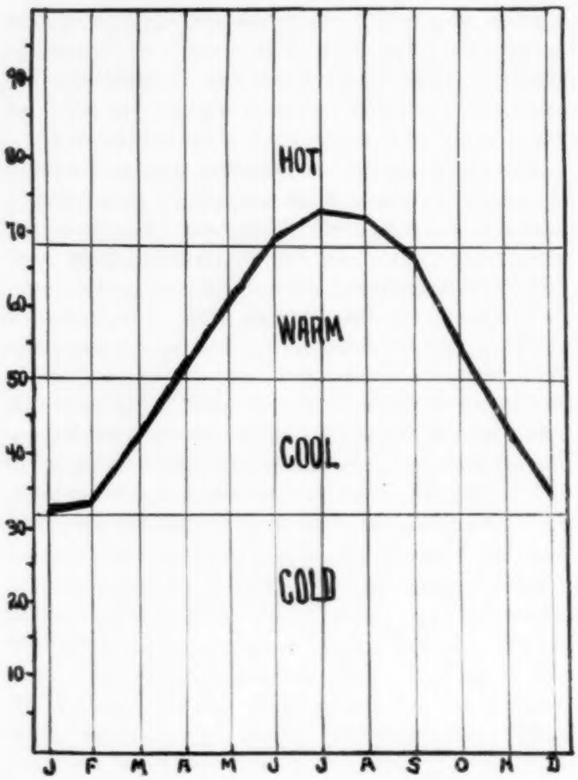

Figure 3—Climatic chart showing the average temperature of each month for Dale Enterprise, Virginia.

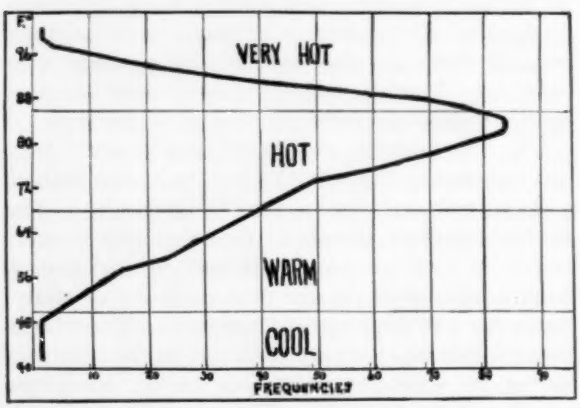

Figure 2—Graph showing frequency of the maximum temperature of each day in the warmest six months during ten years on Madison College campus, Harrisonburg.

The announcement below, received from the New Jersey Science Teachers Association, is an example of the kind of "something different" news we would like to receive from NSTA Affiliated Groups for mention in TST. *What is your local science teachers' organization doing that should receive national publicity?* EDITOR.

H. Herbert Fox, senior chemist with Hoffman-LaRoche, Inc., has been selected to receive the Scroll of the New Jersey Science Teachers Association as the New Jersey resident who has contributed most to science during the past year. The award is being given to Dr. Fox for his work on the chemotherapy of tuberculosis and his discovery of the anti-tubercular hydrazide. The Scroll will be presented to Dr. Fox at the Association's dinner in Atlantic City, November 13. Stuart Faber, President of the Association, will make the presentation.

SCIENCE FICTION

—asset or liability?

By CHARLES C. SMITH

ON a least three occasions during the Pittsburgh Convention of NSTA I heard the speaker couple science fiction with comic strips and casually dismiss them as distracting factors in the environment of our youth—annoying, but relatively harmless.

Having read science fiction for many years I was disturbed and concerned. I was disturbed because I have definitely enriched my science background by reading this literature. I was concerned because I have on numerous occasions recommended some particular science fiction story to my students when I sensed from their questioning that whole new worlds of ideas had suddenly opened up for them. I can still remember the thrill of my first imaginative venturing into future worlds with the stories of Wells, Verne, Leinster, and Verrill, and I wanted my students to have that same vivid and stimulating experience. But if science fiction is no more than comic-strip stuff which doesn't deserve more than a tolerant nod from the serious scientist then I am misleading my students. I am encouraging distortion and misinterpretation of the science I am committed to teach. It is the strong conviction that science fiction is much more than Flash Gordon and Buck Rogers that has impelled me to speak up in its defense.

Is science fiction no more than comic-strip stuff which deserves no more than a tolerant nod from serious scientists—and no nod at all from science teachers? Or, is it much more than Flash Gordon and Buck Rogers with constructive elements which science teachers can capitalize upon in their teaching?

Charles C. Smith, who teaches chemistry and physics at Radnor High School, Wayne, Pennsylvania, believes the latter is the case. And when he encountered the opposite point of view a number of times at the Pittsburgh convention of NSTA last March, he was disturbed enough to go home and write this article. We're glad he did. We like his paper and believe you'll be glad to read it, too. In recent years, Smith has been on the summer session staff of the Department of Education, Temple University, Philadelphia.

Fiction is a recognized medium for presenting to the reader the knowledge, observations, concepts, and conclusions of the author. If the fiction is worthwhile the reader acquires increased knowledge and understanding vicariously by identification with the characters in the story. If qualified men in the fields of history, politics, economics, or psychology can use fiction to give life and vividness to their knowledge and theories, why not the man of science? Is there anything unique about the body of science that forbids imagination and even speculation about the future development of science? If fiction can give "reality" to medieval life in England with Scott's *Ivanhoe,* is it not equally effective in giving "reality" to the moon through the medium of *Destination Moon,* or Campbell's *The Moon Is Hell?*

We as teachers pride ourselves in being exponents of the scientific method. We insist that our pupils consider all available data and that they be completely objective in reaching conclusions and judgments. Are those of us who dismiss science fiction with a smile equally objective in our evaluation? Have we read enough of it to pass judgment? Do we know who writes it? Who reads it? Have we considered its impact particularly on the minds of young people with awakening scientific interest? Do we as teachers accept the responsibility of using its motivating force intelligently?

I have heard science fiction condemned with such terms as "wild . . . fantastic . . . impossible . . . unscientific . . . childish". Are these terms valid? Twenty years ago I read stories featuring television, atomic warfare, rocket planes, space stations, and robots; these stories, too, were laughed at as fantastic and impossible. I do not mean to imply that science fiction claims to predict the future. Its writers would be the first to insist that no such claims are intended. They are concerned only with taking the known body of science today and by projection and

extrapolation, suggesting probabilities for the future. If these writers have a functional knowledge of present-day science and have had experience in projecting, their results are as valid as the work of the research man in the laboratory. Their limitation lies in the fact that time must carry out the suggested experiments and verify them. We do need these "dreamers" and the stimulation they give our youth. The realities of tomorrow must be built upon the dreams of today.

Who are these "dreamers" of science fiction? Are they qualified in the fields of science? Do they have proper background and scientific training? Or are they primarily fiction writers who use a superficial knowledge to exploit the current popular interest in scientific advancement? Certainly there are some stories that are more fantasy than science. We would not recommend stories about superman-heroes dashing about in time-machines rescuing beautiful maidens from bug-eyed monsters. Neither would an English teacher recommend Mickey Spillane. But great writers and reputable scientists have also made their contributions to this literature. Their writing, too, is a part of the data and must be accounted for in the conclusion.

Science fiction is generally thought of as a development in the present century, but actually it has a history extending far into the past. Anthologists list among its early examples: Plato's *Atlantis,* More's *Utopia,* and Bacon's *The New Atlantis.* They continue with such names as Swift, Defoe, Kepler, Poe, Verne, Bellamy, Wells, and Buchan. These men and many more were intrigued by the challenge of the future and tried their hand at projections and probabilities. Some of them were scientists, others were not. Their contributions in either case were good enough to find a permanent place in literature and are very likely the seed from which our modern science fiction has developed. We may question the inclusion of these early writings in the science fiction category. It is true there is limited science material in them, and rightly so because science itself as a vital force in man's progress is a concept that has developed since their time. But the intent of the writers then differs very little from that of the current writers. Each group found in their realization of man's progress an urge to project that progress—call it dreaming if you will—and visualize its impact, for good and evil, on man. The current writers in an

environment of bewildering growth in every field of science naturally select and concentrate on some special phase of science. That is why we can classify modern stories into such groups as: space travel, galactic adventure, atomic power worlds, science states, controlled evolution, hormone synthesis, psychosomatics, telepathy, telekinesis, semantics, electronic brains, cybernetics, robotics, time-travel (which is merely a literary device for placing the setting in the past or future), fourth-dimensional worlds, life on other planets (very often an objective way of presenting problems in comparative psychology), etc. These are some of the areas of serious writing in science fiction. Along with these we have the "space opera", the hero-villain adventure which has simply moved its locale from the "Wild West" or the jungle out into space or to other worlds. Unfortunately, it is the latter type story which is responsible for most "un-studied" opinions concerning science fiction.

Who are the men who write the stories? Do they have enough science background to be taken seriously? Any regular reader of science fiction will recognize the following as outstanding authors in the field.

Eric Temple Bell is well-known for his work in the field of mathematics; as John Taine he is equally well-known for his science fiction novels. E. E. Smith, Ph.D., is an experienced food chemist, George O. Smith was a project engineer on the proximity fuze, Isaac Asimov is a biochemist in the Boston University School of Medicine, Fritz Lieber is associate editor of *Science Digest*, Sprague DeCamp is a consultant engineer. These men, and many more, have attained positions in science and engineering which leave no doubt as to their qualifications. The fiction they write may seem to some readers fantastic, impossible, or unscientific, but there can be no doubt that it is backed by a sound knowledge of scientific principle and a keen insight into its effect on human society. To the above roster of writers should be added such names as Heinlein, Sturgeon, Bradbury, Williamson, Ehrlich, and Van Vogt who have equally good reputations as writers of serious science fiction.

For many years the popular form of science fiction was confined to a few "pulp" magazines. Looking back on it, evaluating it by modern standards, it was rather crude, stilted, and melodramatic. Much of it was typical "space opera". Within the past few years it has matured into a respectable field of literature. For this, there is concrete evidence. *Time* and the *Saturday Review of Literature* have given space to evaluating it. *Colliers, The Saturday Evening Post,* and similar magazines have carried stories by Bradbury, Heinlein, and others. Random House, Simon and Schuster, and Doubleday have begun putting science fiction novels in hard covers. Doubleday has organized a Science Fiction Book Club. Anthologies and novels in the twenty-five cent paper-back are always in evidence on the newsstands. Unquestionably, the reading public has given an encouraging nod to this new type of popular fiction. Have we, as science teachers and scientists, been blinded in our evaluation by our reactions to Superman and Space Cadet?

Whether we realize it or not, our students are reading this fiction and they find it stimulating. At the Pittsburgh Convention I listened to the speaker describe a recent speculation made by atomic scientists concerning the probable existence of negative matter—"negative protons" in the nucleus and positrons outside. This called to mind a discussion I had with one of my students last year. He had just read "Seetee Shock" by Will Stewart, built around the concept of negative or contra-terrene matter. He had acquired the general concept of negative matter—as I had—by riding in imagination with Nick Jenkins through uncharted space among the asteroids prospecting for "Seetee". The boy knew its potential for destruction and for power because he had lived through the fears, nervous strain, and tensions with Nick. There was reality in the problems of detection, maneuvering, collecting into bunkers shielded with force fields. Through the struggles of two contending groups—one planning to use "Seetee" for weapons of conquest, the other planning to energize a transmitter of free power throughout the solar system—the boy learned vividly the potentiality for power, both constructive and destructive. He was thrilled with the knowledge he had gained and the reality of the concepts involved—thrilled as he never had been by my teaching or my textbooks!

I could describe many similar experiences with students. Here is a great motivating force thrown right into our laps. What are we going to do about it? Can we afford to ignore the responsibility of guiding our students through the good, bad, and indifferent grades of science fiction that beckon to them from newsstands, radio, and television? Do we have the vision to see that if wisely selected we can use it for motivating and teaching? The test might be to read some of it and see if we are still mentally young enough to "dream"—human enough to put aside our test tubes and slide rules at times and encourage our youth to dream of a Brave New World.

TRY THE *Inductive* APPROACH

By CLARENCE H. BOECK

A year or so ago, we listened with great interest as Clarence Boeck reported on his doctoral study of the results obtained through the use of two almost-opposite approaches to the teaching of high school chemistry. We inquired: "Why not take the core of your findings, select a typical instructional area, and tell other chemistry teachers—directly and in immediately usable terms—just 'how you do it' to use the inductive approach successfully?"

Here is Dr. Boeck's answer. Whether you teach chemistry or some other science course, we believe you will find many pointers in this article that you can inject into your own teaching—for the better advantage of the students. If you would like to delve into the experimental evidence that substantiates Boeck's thesis, look up his article, "The Inductive-Deductive Compared to the Deductive-Descriptive Approach to Laboratory Instruction in High School Chemistry," in the March, 1951 issue of *Journal of Experimental Education*, pp. 247-53.

Dr. Boeck is an experienced high school science teacher. He is Assistant Professor at the University of Minnesota, where he completed his doctorate, and also teaches in the University High School there.

WHEN science teachers pass up the use of an inductive approach in their teaching, they miss a golden opportunity to improve their chances of attaining one of their avowed and highly regarded objectives of science teaching—*the development of ability to use the methods of science with an accompanying scientific attitude,* and without a loss in the understanding of basic science principles or the ability to apply them in new situations. While teaching through the application of this mode of instruction opportunities are given to pupils to plan and carry out experiments to get answers to their own questions. The data obtained during the experimentation are not only useful in answering the specific questions but may, through further analysis by the class, lead to statements of scientific principles. This teaching is easily contrasted to the sort, much more commonly found, in which the general principle is read, explained, and discussed in detail and then demonstrated through the use of laboratory exercises of the descriptive or illustrative type. The following is a brief description of inductive teaching in high school chemistry carried out by the author at the University of Minnesota High School.

The general properties of acids and bases had been developed during the early phases of a unit involving these general compounds. The instructor was then interested in having the pupils develop an understanding of the relationship between oxides of metals and non-metals and the formation of acids and bases. The first of a series of class periods leading to this end was opened with the teacher asking if the pupils knew how carbonated drinks were made. He received one answer, a suggestion that something like *7-UP* could be made by putting dry ice into lemonade. Anticipating this or a similar answer, the materials were on hand to try out the suggestion. The pupils decided, after sampling the product, that the resulting solution was acidic as indicated by its sour taste. However, no class member would say with conviction whether the acid properties were due to the lemon juice or the carbon dioxide-water solution or both. It was both quick and simple to check these materials with red and blue litmus paper and to find acid properties indicated in both instances.

The teacher's key question came next, "If carbon dioxide dissolved in water produces an acid solution, will other oxides produce similar solutions?"

Guesses of yes, no, and maybe were immediately forthcoming. Because there was a difference of opinion to be settled, it was decided to check the hypotheses by going into the laboratory for objective evidence. With the problem defined and accepted by the pupils the planning phase was initiated. The class suggested the materials to be tested and the method to use.

Pupils do not do these things without the guidance of leading questions from their teacher. The teacher plays a leading and highly important role here for he will know the direction the pupils should take to be most successful and which suggestions be discarded as being impractical usually because of the excessive time required to complete the experiment, the local unavailability of the materials needed, or the extreme complexity of the plans as well as be able to get the pupils to see these dif-

ficulties themselves upon his suggestion. Patience and a sense of timing are essential. The real values of a planning session can be completely lost by giving answers too soon or by allowing the work to drag when suggestions are not likely to be made without hints from the instructor. Many who try this type of teaching for the first time will find that the class members are slow to express their ideas. They are often completely silent and do not seem to know how or where to start. This might well be expected since any completely new experience may lead one to a state of confusion or frustration. Or better perhaps, the pupils may be likened to Walt Disney's dwarf, Dopey, from "Snow White and the Seven Dwarfs" who did not talk. He did not know whether he could or not for he had never tried.

To return to the pupil planning, the class first suggested the metallic oxides it wished to check: barium, zinc, magnesium, iron, copper, and the nonmetallic oxides: sulfur dioxide, silicon dioxide, and phosphorus pentoxide. The pupils also decided to make water solutions of each, if possible, and to test each with both red and blue litmus paper after any necessary filtering. Setting the problem and planning the experiment took a single class period. No reference was made to text materials for ideas as to how to proceed during the planning phase, for the consulting of references could easily have provided the final answer to the problem before the collection of evidence. Had this happened the chief values of this form of teaching, the planning, collection of data, and the analysis of the data would have been lost.

Because all the oxides required in the experiment were available in pure form in the laboratory there were no problems involved in obtaining them. Had some of the oxides been available only through on-the-spot preparation, however, an increase in the length and breadth of the exercise and a review of previously studied materials would have resulted.

On the second day the experiment was carried out and the results were recorded. Many pupils were surprised that some of the solutions were acidic and some were basic while still other combinations were neutral. When, during the laboratory period, the teacher noted neutral reactions, he asked the experimenter for possible explanations but gave none himself. The laboratory phase was completed in about half a period. Upon completing the experiment the pupils were asked to examine their tabulated results to obtain an answer to the question which started the laboratory work and to draw a more general conclusion if at all possible. The written reports, data, problem answer and general conclusion, were collected and checked to be returned the next class period.

Most of the first attempts to draw a general conclusion were relatively poor. They resulted in such a general statement as, "Some oxides produce acid solutions, others basic, and some didn't react at all." The inadequacies of such a conclusion were pointed out and a united class effort was directed toward producing a better one. The data from all the experiments were tabulated on the chalkboard. Where there were differences in data as presented by different pupils, demonstrations were used to substantiate one piece of evidence or another. A uniform body of information that represented data obtained under controlled conditions and from repeated experimentation was then available for analysis. The instructor then suggested that a reorganization of the data might show some relationships not previously seen. The reorganization plan suggested by one pupil was to put all acid-forming oxides in one group and the base-formers in another. The third remaining group was composed of those oxides that gave neutral reactions. Questions were then asked about the materials whose oxides produced the basic solutions. When it was established that they were metals the proper conclusion was soon drawn. Similar work indicated that the acid solutions resulted when nonmetallic oxides were used. Another attempt was then made at conclusion drawing. In this instance the usual attempt carried the pupil beyond the data available for no provision was made for those oxides which were insoluble and consequently gave neutral reactions. Upon pointing this out a satisfactory *tentative* conclusion was written. Since the number of oxides examined was limited, it was pointed out that the final statement was still open to question. Here was an ideal time to use the textbooks. They were used to determine whether or not the tentative conclusion was supported by the work of others and could be accepted. The usual statements were found on the subject and the reading matter also added a new word, ***anhydride,*** now defined in terms of concrete experience as well as verbally.

Of course, all aspects of a science field cannot be developed in this manner, but such teaching and its results may be used as a starting point for further work to be carried on in other ways. In this particular case, the experiment became the basis of an exercise in equation writing. After this, the question was raised as to the composition of the anhydride of sulfuric acid. The subsequent

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THE DETERMINATION OF SCIENCE MATURITY AS A MEANS OF IMPROVING THE PROGRAM IN ELEMENTARY SCIENCE

By CLIFFORD G. McCOLLUM

THE teacher in the elementary school often asks, "What units or lessons in science should be taught at each of the grade levels?" I have often heard this question from prospective teachers as well as teachers in the field. I suppose a partial reason for this persistent inquiry rests upon the fact that no definite state course of study exists in Iowa for elementary science. Most of our teachers who are teaching science rely upon the outline of the textbook series they are using. I would not want to imply that elementary teachers *in toto* are dissatisfied with the organizations of elementary science textbook series *in toto*. However, I frequently have teachers tell me, "That unit on electricity in our textbook is too difficult for my pupils," or "The chapter on soil in our text doesn't present anything that my pupils don't already know."

We are encountering an interesting criticism of elementary science in our state. Teachers of secondary-school science, followed by their principals and superintendents, are saying, "I wish they'd stop fooling around with science in the grades. My pupils used to be enthusiastic about science. Now all I hear is 'Aw, we studied that in grade school.' They might have studied it, but they don't show it." These remarks illustrate that elementary science has been with us but for a short time.

I do not insist that these questions and criticisms are valid to the extent that we need radical changes in our organization of science subjectmatter for elementary pupils. Nor would I imply they are unique. Instead, they serve as reminders to me that problems of program planning will always be with me and with all teachers of youngsters. For with a belief in flexibility of curriculum comes the responsibility for continuous planning, evaluating, replanning, reevaluating.

There is no single criterion to be utilized in planning science experiences. We use the terms "needs and interests" quite frequently. To describe them and show their changing pattern is something different. Needs involve the present and the future. Interests may be most superficial and fleeting; they may be deeply engrained and enduring. Whether we plan for a year's experiences, a unit, or a daily lesson, the background of the pupils, in terms of past experiences, present understandings, interests, *etc.* must be considered. A part of this consideration are the questions: "Are they ready for this?" "Can they profit from such a study?" We concern ourselves with background in various manners. I have been interested in attempting to study the whole complex of the so-called "background" which children bring to segments of formal science subject matter. In attempting to systematize such a study and report it, I have used the term "science maturity" which probably requires some explanation.

Maturation, of course, refers to development physically, emotionally, socially, and mentally—as divorced as possible from learning. Learning involves developmental progress, too, in the same areas with more purpose, more organization. Both maturation and learning are involved in this background mentioned before. The relationship of this complex of maturation and learning to new experiences has been studied and referred to in terms of reading readiness, arithmetic readiness, *etc.* I hesitate to speak of science readiness since several basic skills and a group of understandings seem to be involved. Instead, I speak of searching for evidences of changing and developing science maturity.

This paper was read before the elementary science section of the St. Louis meeting of the AAAS science teaching societies last December. It stimulated discussion and questions both among the elementary teachers and the science researchers who were present. We are pleased to pass this article along to readers of *TST*—and to remind you that the 1953 counterpart of the meeting at which Dr. McCollum read this paper will convene December 26-30 in Boston, Massachusetts.

Following receipt of his B. S. in Ed. degree from the University of Missouri in 1939, Mr. McCollum taught science in the public schools of Monett, Poplar Bluff, and Boonville, Missouri. He returned to UM and earned his A.M. in 1947, his Ed. D. in 1949. Today Dr. McCollum is Assistant Professor of Physical Science in the Iowa State Teachers College at Cedar Falls.

Is there a pattern which may be discerned? Would such a pattern have value in curricular planning?

A part of the considerations to be made for grade placement of science experiences must rest in an understanding of the nature of children. Where are the points of greatest similarity? Where are the points of most diverse individual differences? Studies of child development may not have been used enough for this purpose. At least, there is still need for relating the nature of the child, as an individual and in groups, to the formal science experiences he has in school. A number of studies in this area have contributed much for us. I could point to many; I would like to mention especially those of Deutsche [1], Haupt [2], Huang [3], and Oakes [4] as being particularly fruitful in relating the child to his science curriculum.

My belief that the study of science maturity could be helpful in improving the program in elementary science is based upon an investigation carried on during the 1948-49 school year. This study was described in a recent issue of *Science Education* [5], but there are some implications not discussed there that I would like to mention. The study was essentially designed to evaluate the success of an individual interview technique in securing evidences of changing maturity as related to science subject matter. A standardized schedule was developed for interviewing children through the first six grades of the elementary school. The content of the schedule was distributed through both physical sciences and biological sciences, and was based upon recommended courses of study in elementary science. Responses elicited were both verbal and performance reactions. The interview required a kit of materials, including such things as pictures, thermometers, electric doorbells, samples of rocks, magnets, compasses, seeds, *etc.* Items in the schedule were arranged in a number of subject-matter categories. These categories were: Seasons, Water, Weather, Astronomy, Geology, Air, Magnetism, Electricity, Adaptation of Plants and Animal Life, Machines, Energy and Work, Chemical Changes, Bacteria and Disease, Problem Solving and Attitudes. Within a category, attention was given to distributing the responses through such a range as from simple identification to development and expression of a generalization.

A sample from the schedule may illustrate the general nature:

I. Seasons.

1. What are the seasons of the year?
2. How does summer differ from winter?
3. a. *Picture of trees with brightly colored leaves.*
   What season of the year is it in this picture?
   What makes you think so?

   b. *Picture of geese flying in V-formation.*
   What season of the year is it in this picture?
   What makes you think so?

   c. *Pictures of a weasel with dark fur and one with white fur on same card.*
   Pointing to the one with white fur: What season of the year was it when this picture was made?
   What makes you think so?

   d. *Colored picture of a field of wheat ready to be harvested.*
   What season of the year is it in this picture?
   What makes you think so?

Verbatim reactions of children were written on specially prepared record forms. Descriptive statements of performance reactions were also noted.

The schedule was subjected to trial by interviewing 324 elementary-school children in Cooper County, Missouri. The interviewers were selected from the first six grades of rural, village, and small-city schools with approximately equal distribution in numbers between sexes and among grade levels and the three types of schools.

The responses were analyzed to note differences among the different grade levels. Groupings and categorizing of the responses were largely in the words of actual responses. The frequencies of the various responses at the different grade levels were converted into percentage frequencies, based upon the number of children interviewed in each grade. These percentage frequencies were then graphically represented. The graphs were the primary reference in considering the significance of specific responses. A number of responses were usually graphed for each of the individual questions.

There were four general types of graphic distributions. First, there were those that tended to in-

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[1] Deutsche, Jean Marquis. *The Development of Children's Concepts of Causal Relations.* Institute of Child Welfare, Monograph No. 13, University of Minnesota Press, 1937.

[2] Haupt, George W. "First Grade Concepts of the Moon." *Science Education,* Volume 32, Number 4, October 1948, pp. 258-262. "First Grade Concepts of Hot and Cold." *Science Education,* Volume 33, Number 4, October 1949, pp. 272-273. "Concepts of Magnetism Held by Elementary School Children." *Science Education,* Volume 36, Number 3, April 1952, pp. 162-168.

[3] Huang, I. "Children's Conception of Physical Causality: A Critical Summary." *Journal of Genetic Psychology,* Volume 63, 1943, pp. 71-121.

[4] Oakes, Mervin E. *Children's Explorations of Natural Phenomena.* Bureau of Publications, Teachers College, Columbia University, 1947.

[5] McCollum, Clifford G. "A Technique for Studying the Maturity of Elementary School Children in Science." *Science Education,* Volume 36, Number 3, April 1952, pp. 168-175.

crease in frequency from the first grade toward the sixth. Second, there were those that tended to decrease through the grades. Third, there were those that had their highest percentage frequencies in the middle grades with lower ones in the first and sixth. Fourth, there were those that were irregular with no discernible trend toward either an increase or decrease through the grades. The first two were of most interest in that they identified responses indicative of changing maturity through the grades.

To illustrate types of responses showing some of these patterns of distributions let us consider some of the actual items and reactions.

A picture of a window open at both top and bottom with a radiator below it is shown to a child. The interviewer says, "Here is a picture of a window. It is open at the top and it is open at the bottom. It's cold outside. Where will the cold air come in this window?" There were ten per cent of the first-graders who answered, "At the bottom," and sixty-three per cent of the sixth-graders with progressively increasing frequencies between. In contrast to this, forty-four per cent of the first-graders and three per cent of the sixth-graders responded that cold air would come in at both the top and the bottom with progressively decreasing frequencies between. There were thirty-eight per cent of the fourth-graders who answered, "At the top." The frequency of this response decreased at both higher and lower grades.

The children were asked whether they believed the answers their father, mother, or teacher gave to their questions were always right. About seventy-three per cent of the first-graders answered, "Yes," and thirty-eight per cent of the sixth-graders. Fifteen per cent of the first-graders said, "No," and forty-three per cent of the sixth-graders. The changing frequencies between these levels displayed a consistent increasing or decreasing pattern.

There were many evidences of wide individual differences. No responses were distributed through the grade levels from zero per cent to one hundred per cent frequency. Explanations given by sixth-graders were also given by first-graders. Even the vocabulary used in identification and explanation in many instances extended throughout the range of the grade levels. It was a changing frequency rather than a complete change in type of response that distinguished between grade levels.

Work with such a schedule has led me to believe that there are possibilities for the refinement of such an instrument to study rather objectively the entire complex of background which a group of children bring to a study of elementary science. I believe it might also be possible to consider the comparative readiness of individuals within a certain population for specific science experiences.

The patterns of the changing frequencies of occurrence of the responses were indicative of a developmental progress, whether it be due to maturation, learning, or both. A course of study could be more soundly based for the children involved if such questions as the following are of any significance: How much do they already know at each grade level? Is it possible for any sizable number of children to work with this concept at a certain grade level? I feel that the study of science maturity could be a help in the development of group programs for specific environments—for particular groups of children. At the same time it could be a ready indicator of the need of providing for individual differences.

Indications from the results of my investigation were that it was not just a matter of mental development as measured by intelligence tests. The so-called science maturity was broader than that although, as might be expected, there was some positive correlation between the two.

Can I expect fifth-grade children in a rural school to bring the same degree of readiness to a unit in electricity as a group in an urban school? Such questions as this might be attacked through such a method with less trial-and-error.

Would a curriculum based upon such a study differ from existent ones? I believe first in answering this we would face the fallacy of a universal program. The program and the materials utilized must be modified from environment to environment—from time to time. What bases should be employed for the modification? There should be many but it seems to me that many of these in their interaction can be learned from the controlled observation of the reactions of children themselves—evidences of a changing maturity in relationship to science concepts.

COLLEGE TEACHERS:

PLEASE LISTEN!

By MARY BERRONG

Fifth-Grade Teacher, Weatherford, Oklahoma

I TRAIN TEACHERS. I train teachers to teach children. I train teachers to teach children *science*. ONLY they can't do it! Why?? They don't know SCIENCE!

Now, just a minute! I hear what you are saying, "OUR elementary teachers know *their* science." OR, "*Your* training institution is inferior." OR, "If they have had Nature Study and Science Methods they can do it." UH UH!!

I, scientifically of course, dare you to check the following: Take the first 500 elementary teachers in ANY system:

1. Are they teaching science? (As SUCH, not integrated until it is watered down the drain!)
2. Why are so few of them doing an effective, inspirational piece of work? Why are they either afraid of it, uninterested in it, or do they not have time for it?
3. WHY *didn't* they get what they needed in college? (Did dissecting an earthworm or learning Periplaneta americana seem somehow to miss the points needed by children? Was too much crammed into too little time in nature study? Was only a fraction of the field of science touched upon?)

SO, now you've checked your 500 elementary teachers. You've found out SOMETHING!

What do I propose to remedy this basic need? THIS: For one hour a day, five days a week, for 36 weeks (I know that this amounts to 10 semester hours as well as you do!) I propose a course in basic science understandings taught by *everybody* on the science staff. (Start hollering about how to grade the students and I'll tell you to require a grade for each week and let some sixth-grader average them at the end of each quarter or semester.)

NOW you say, "*How much* of *what* do they need?" (Before I answer that, I can tell you it would be a help if the plant department is speaking to the animal department, and if the animal department thinks the star department has sense enough to stay away from a tall tree in a thunderstorm!)

Believe me, the following itemized list would help a LOT. And should the various departments survive long enough, twenty years from now they might notice quite a difference in the quantity and quality of the timber entering their mills!!

Weeks in the year of any college

SEPTEMBER
1. Insects (Butterflies, Moths)
2. Insects (Pests, Helpers)
3. Spiders (Other backboneless)
4. Trees (Broadleaved)

OCTOBER
5. Trees (Broadleaved)
6. Trees (Evergreen)
7. Fruits, Seeds
8. Non-green plants

NOVEMBER
9. What are things made of?
10. What are things made of?
11. Rocks, Minerals
12. Rocks, Minerals

DECEMBER
13. Earth
14. Moon, Planets
15. Stars

JANUARY
16. Seasons, Weather
17. Weather Forecasting
18. Examinations!

FEBRUARY
19. Magnets, Electricity
20. Sound, Light
21. Gravity, Machines
22. Airplanes

MARCH
23. Human Body
24. Community Health
25. Flowers (Cultivated)
26. Flowers (Wild)

APRIL
27. Shrubs
28. Sea Life
29. Fish
30. Amphibians

MAY
31. Reptiles (Ancient, Today)
32. Birds (Dooryard)
33. Birds (Water, Migrant)
34. Mammals

JUNE
35. Mammals
36. Examinations!

Explode now! I can hear you! Most unscientific collection of science topics you ever saw! EXACTLY! Those are the very things my teachers need desperately to know a LOT about. Somehow, handling 30 children, 60 parents, 1 principal, and 4 cadet teachers leaves me too little time to

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SCIENCE PROVISIONS FOR THE RAPID LEARNER —*a Symposium*

Coordinated by SAMUEL W. BLOOM

(Continued from the September issue of *The Science Teacher*)

Joseph M. Cadbury, Germantown Friends School, Philadelphia, Pennsylvania, makes provisions for the rapid learner at the elementary school level.

"What can be done for the rapid learner in the elementary school? At the Germantown Friends School where I teach we are fortunate in having a departmental set up so that the science work is under the guidance of one teacher throughout the lower school. This gives unusual opportunity for follow up from year to year of children with particular interest in science. Too often these interests flourish under a sympathetic teacher only to fade as the child progresses to another grade.

"But to be more specific there are a number of things which can be done to encourage the gifted child in science. One activity consists of club or hobby groups after school. These groups are formed around some common interest which they pursue as time and continued interest dictate. They are kept as informal as possible with a minimum of the usual embellishments of formal organization such as dues, minutes, etc. so that the entire time may be concerned with the matter at hand. Such groups may be temporary or may follow through with their interest for one or more school seasons.

"Another extra-curricular activity which helps to foster special interests is the field excursion. These are frequently used as an accessory to the club groups already mentioned or they may be single trips for the purpose of collecting, exploring or observing.

"I believe that it is important to emphasize the interests of the teacher as it seems obvious that one teaches best those subjects in which he has a particular interest. My own interest happens to be ornithology and as a result a number of my students have become ardent 'Birders.' For those with this hobby there are birding expeditions. These trips frequently go out before school during the migration period to a nearby park returning in time for the beginning of the school day. I have found these trips of exceptional value in stimulating interest and in fostering the activity of those students who want to go ahead of the rest of the group.

"As for in-school activities there are often special projects which are carried on by children with unusual capability. These projects may take the form of research with reports to the rest of the class. Or, they may be exhibits or demonstrations to be used in connection with some science project. Or, again, they may take the form of an exhibit for the whole school to enjoy or the preparation and planning of a program for the school assembly.

"As an example, we are now in the process of preparing a program which involves the whole elementary school, the theme of which is the history of science. This program has offered many opportunities for the gifted child in planning, research, and organization of science materials. It has also had a strong unifying influence on the whole school and in its completed form will be presented to the parents and friends of the school as an assembly program.

"Another excellent stimulus is the making of collections. These are the result of the natural acquisitive tendencies of children but are not considered as ends in themselves but rather as a stimulus to finding out more about the specimens collected.

"Frequently there is opportunity for help in caring for materials in the science room. This room serves as the focal point for all of the science activity in the school. It is a sort of combined classroom, laboratory, and museum. Since there are always a number of living things in residence there is ample opportunity for help in their care and feeding. And there are many possibilities for assistance in the preparation of special exhibits or in the care of school collections.

"These ideas are not new or original but perhaps they may suggest ways in which the gifted child may be given the opportunity to expand his interests and to contribute to the learning experiences of his fellow students."

The science teachers at the Wilbur Wright Junior High School, Cleveland, Ohio, William Niehaus, Charles Robison, and Daniel Healy, collaborate in reporting:

"The school in which we teach is one of three centers for the gifted students of junior high school age. We receive these pupils from the West and South sides of Cleveland. Our school enrollment is approximately one thousand students, one sixth of this number being gifted (Binet I.Q. 125 or above). Cleveland works under the plan of homogeneous grouping. The gifted and average pupils take the same subjects, but in addition, gifted students study French. Many are also enrolled in band, orchestra, choral club, journalism, typing, and dramatics. All work with these students is based upon the enrichment theory.

SCIENCE DEPARTMENT PROCEDURES

"We furnish each pupil a mimeographed outline of study. We find that this is an aid to the pupil in study; thus, the child has an explicit task for which he can budget his time advantageously. For the teacher, this makes possible long range, definite assignments. At Wilbur Wright, as much as possible, we have one teacher for each grade in science. This provides an opportunity for teacher specialization in one area of science.

"Each science room has numerous projects, charts, models, pictures, and collections hanging on the walls. This lends atmosphere, inspiration, and interest.

"One day each week is set aside for visual education which supplements the material the class is studying. Part of one period each week is devoted to a discussion of current science topics.

"In each of the grades, we use various methods of presentation such as class discussions, demonstrations, experiments, collateral readings, films, reports, radio lessons, models, science projects, and games to stimulate competition. For the rapid learner sections, we include additional units (e.g. ninth grade, atomic energy and heredity) wider collateral reading, and stress more depth of thought in class discussions of science laws and theories.

PROJECTS

"Unit projects: these are small projects that take only about two to four hours to make.

"Semester projects: These are for the pupil who has studied and read very widely in a number of science fields. Regular class work is not challenging enough for him and he becomes bored. An example of this type of project can be found in the March 1952 issue of *The Science Teacher*, entitled, "A Transparent Working Model of the Human Digestive System." This is an article by Hollis Frampton, a former Wilbur Wright pupil. At present we have a boy who is building a weather forecasting station for the school as his project for the semester.

"We submit a partial list of projects which have proved successful:

1. Writing reports requiring research in the library concerning a specific subject
2. Building original projects or putting together apparatus which has been suggested by books or magazine articles
3. Preparing illustrated radio lessons. This involves library research, script writing, recording on wire or tape recorder, preparing mimeographed pictures, charts, diagrams, or notes on simple demonstrations, to be used with the radio lesson
4. Making charts or diagrams on window shades for class drill and tests
5. Collecting insects, parts of auto engines, rocks, etc.
6. Making simple microscope slides of insect parts
7. Making plaster casts of footprints, skin, and leaves

"The purpose of projects is multiple:

1. To prepare material or projects that can be used in future classes
2. To assemble drill work that can be used later as a test
3. To provide exhibits for classroom walls to establish scientific atmosphere
4. To give children a chance to contribute to the school which has helped them

"The field of science lends itself to a great number of hobbies. Therefore, we enrich the subject content to develop avocations for the future amateur scientists, thus providing a release from the tensions of life. Science avocations have been a great factor in recent discoveries and inventions. Our scientific age has mechanized the home, consequently, we broaden the horizon so that the future homemakers may economically and advantageously make use of new appliances.

"We endeavor to help the pupil who plans to make science a career to gain a broad but intensified view of science so he can choose his field wisely.

"Ninth-grade science is an elective subject in the city of Cleveland. For the past five years, sixty-five to eighty-five per cent of ninth-grade pupils at Wilbur Wright have elected ninth-grade science. This record confirms our belief that we have an interesting and worthwhile approach both as to content and presentation."

Jerome G. Denaburg, of the Baltimore City College, Baltimore, Maryland, discusses an accelerated program.

"The Baltimore City College provides an accelerated college preparatory curriculum for its superior high school students. Many factors are considered in arranging a homogeneous grouping for these students. The intelligence quotient, scholastic achievement, social maturity, health, emotional stability, and parental approval are considerations in the placement of students in the acceleration program. During the first three years of a four-year program of study, students complete fifteen units of a required sixteen-unit high school schedule. In the fourth year, subjects of freshman year college level are taken enabling students to enter the sophomore class of college.

"Although acceleration is achieved over a four-year period, enrichment is the emphasis within the high school subject structure. In the biology classroom, enrichment does not take the direction toward an increase in subject matter content but is geared toward an attempt to foster and strengthen those characteristics which make for superiority in the accelerated student. Educational leaders [1] agree that among these characteristics are the ability to read widely, to locate pertinent information with a minimum of direction, to think more logically, to draw satisfactory conclusions from available facts, to work with more freedom and less detailed direction, to assume greater responsibility for their own school program, to organize and present materials in logical sequence, to defend their own opinions, to evaluate their own activities, and to search into fields of special interest to give expression to their own special talents. These characteristics are recognizable at the Baltimore City College in the biological program for the superior student.

"The major problem of the teacher of biology is therefore centered about a methodology which will recognize and build upon the traits of the gifted or superior pupil. What methods of teaching will most effectively and most efficiently enable the bright student to approach his potential in the abilities just enumerated? Solutions to this problem vary with the teaching situation. A variety of teaching methods and teaching aids is essential. At the Baltimore City College with the above groups, I have found that class discussion to determine areas of class interest, the small group discussion technique, the laboratory activity, and the project are sufficiently flexible and useful in achieving measurable success.

"Superior students can work with more freedom and they should assume a greater responsibility for their own school activities. During general classroom discussion periods these traits are recognized by providing the student with an opportunity to select the material he wishes to study. A list of problems, or questions, or areas of interest suggested by the students is listed on the blackboard. Which of these do you wish to discuss first? By a process of elimination or by means of a class vote, general agreement is reached and a choice is made. Frequently, this choice proves to be a motivation or a meaningful approach to a large unit of study. For example, one class selected the following problem: Why are some twins alike, whereas other twins differ? A short discussion soon indicated the need for a greater knowledge of the laws governing heredity and a better understanding of the reproductive process. Sub-problems were proposed and listed on the blackboard. The general discussion session thus served to find an area of student interest and to suggest various phases of this interest for further study and development.

"The general discussion period is usually followed by small group meetings. Those students who manifest an interest in certain blocks of the selected unit of study are banded together and these small groups assume responsibility for the development and presentation of the materials within their area of interest. These groups are usually composed of six students with one member acting as a recorder. Each unit sets up its own problems and works out its own program for the presentation of material. Each group thus becomes the resource center in the field of its own choice. The teacher's role in this situation is that of a resource person who makes available to the groups those science department facilities and reference materials which are related to the problem under discussion. Within the group, students in the accelerated program show facility in gathering and organizing facts efficiently. They, however, need assistance in the presentation of their materials. Stress is thus placed upon the importance of delivery and upon originality in sharing materials with the class. This results in the use of pupil-planned and pupil-made charts, maps, slides, models, and skits. Students are encouraged to use materials that can be handled by others. These visual aids not only serve to satisfy the needs of the moment, but they are filed and serve as a source of reference for other biology students.

"The small-group session provides an opportunity

[1] Educational Policies Commission, *Education of the Gifted*. Washington, D.C. National Education Association of the United States and the American Association of School Administrators, June, 1950.

for creative expression, for an interchange of ideas, for greater freedom in selection of subject matter content, for greater responsibility in working out solutions to problems, for a more efficient and more effective presentation of subject matter, for arriving at satisfactory conclusions from available facts, and for giving expression to special talents. It sets up a friendly, competitive spirit among groups which tends to serve as a motivation for serious and effective effort. It encourages the use of good followership and good leadership traits. The small-group activity provides the superior student with the freedom and the latitude to bring into play those traits which they possess as superior students. The teacher must be aware of these characteristics and must strengthen the areas of weakness and build upon the areas of strength so that gifted pupils may derive a maximum value from the small group session.

"Closely associated with classroom discussions and small group functions are the activities in the biology laboratory. Classes enter the laboratory for activities related to the unit of study under consideration. A general assignment is usually indicated. However, students are motivated to pursue directions dictated by their own interests and curiosity. The curiosity of the bright student and his desire to express his own special interests and talents has resulted in a variety of accomplishments. For example, during the past semester one student spent a major portion of the laboratory time cultivating earthworms. Another student, interested in hereditary patterns, mated his panda-colored hamster to a brown male hamster and charted the results of the first filial generation. A third student, unable to see the flagellum of the Euglena, worked upon the techniques of slide preparation to determine the steps necessary for viewing flagella. These and other laboratory exercises similar in scope indicate the direction taken by gifted students when an opportunity is provided for them to follow their own interests.

"The project phase of the program for the superior child is entirely voluntary. A student who wishes to show his ability or interest in out-of-school activities may do so by indicating his plan of action and by developing this plan in project form. Projects are frequently outgrowths of the student's class and laboratory study. Class time is provided for the planning phase of the project but the bulk of the research must be done after class. The project represents more than just a report of accumulated facts. It shows application of scientific procedure, logical thinking, organization of factual materials, originality, and intelligent thought. Examples of the type of self-motivated activities pursued by gifted students may be found in the following titles: (1) Betanaphthoxyacetic Acid as a Plant Hormone, (2) A Study of Symbiotic Relationships, (3) The Inheritance of Blood Types, (4) Biological Warfare, (5) Animal Life Through the Ages, (6) The Evolution of the Microscope, (7) Soil, An Important Factor of Plant Life. Approximately seventy percent of the students in the accelerated class complete projects on the above voluntary basis. The project activity provides another outlet for the expression of the abilities of the superior student. The enthusiasm and the accomplishments of these students in the project field testify to the many values inherent in this type of activity.

"Students in the accelerated course at the Baltimore City College have certain definite qualities which make for superiority. The biology program is planned to recognize the level of these qualities and to provide science activity which will foster the growth of these abilities toward the student's potential. Classroom discussion to determine interest areas, the small group technique, activities in the laboratory, and the project are teaching procedures which have been used successfully at the Baltimore City College in the biology program for the accelerated student."

Classroom Ideas

Biology

Rapid Technic for Permanent Slides of Wood Sections

By MARGARET KAEISER, Department of Botany, Southern Illinois University, Carbondale, Illinois

This method has proven successful and time-saving in the preparation of permanent slides to show microstructural features of gymnosperm woods. As precise transverse, tangential, and radial sections are cut in the usual manner (not thicker than 30 microns) they are placed in 70% ethyl alcohol. The following schedule is then employed:

1. 1% Safranin O in 50% ethyl alcohol—10 min.
2. Wash in 70% ethyl alcohol—1-2 min.
3. 1% Fast Green FCF in 50% ethyl alcohol—45 sec.
4. Wash in weak acidulated water—15-30 sec.
5. 100% ethyl alcohol—1 min.
6. Ethyl phosphate—Practical (Eastman Kodak Company)—2-3 min.
7. Xylene—5 min.
8. Mount in neutral balsam or diaphane, placing transverse section above, tangential to lower left, and radial to lower right in area to be covered by #1 or #0 square cover glass.

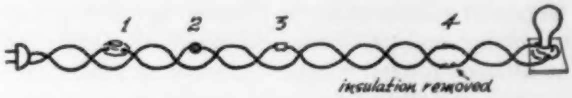
Neither shrinkage nor distortion of tissues has been noted. Microstructures such as cross-field pits, tori, crassulae, primary pit fields, indentures, and nodular thickenings are easily discernible, when present, in both young and mature woods.

General Science

A Simple Fuse Demonstration

By JENNINGS J. KING, General Science Teacher McCormick Junior High School, Cheyenne, Wyoming

An elementary but quite effective demonstration of the function of fuses can be given with a ten-foot length of electric "drop cord." Attach a male plug to one end and connect to a lamp socket and lamp at the opposite end. Between the ends, make three cuts in series about one foot apart.



Attach a socket with a screw-type fuse (10 or 15 amp.) at the first cut (1 in the diagram). Solder a copper coin between the ends of the second cut (2). Keep the third cut (3) "open" for use in testing different lengths, widths, and thicknesses of metal foil, wire, and other materials.

About a foot from the lamp socket, separate the wires and remove the insulation for an inch or so along each (4) so that they can be "shorted" with some kind of metal object with an insulated handle.

Plug the cord into a 110-115-volt outlet.

The students may be allowed to form a semicircle about ten feet away so that sparks and molten metal won't strike them when the circuit is shorted. Sparks do fly and it is always of interest to find what part of the circuit is broken ("burned out").

Among the many ideas gained from such a demonstration, these are probably outstanding: (1) Worn cords of electrical devices may be shorted and cause heavy surges of current. (2) Placing a coin back of a fuse in a fuse box may allow dangerous overloading of the circuit. (3) Fuse materials should be of known standards and sizes to insure proper protection. (4) A person could be seriously shocked and burned before a fuse would "blow" if his body provided the short circuit.

Elementary School Science

As the Twig Is Bent

By CLARK HUBLER, Wheelock College Boston, Massachusetts

One morning a child in the second grade called attention to the fact that it was snowing outside,

yet at the same time the sun was shining. He was puzzled. Another volunteered the information that the sun is always up in the sky. Someone else said, "But where is it at night?" Many of the children submitted their ideas about the sun, some true, some distorted or false. Rather than giving direct answers to their questions, the teacher helped them to clarify their questions and listed these on the board. The next step was to decide how best the questions could be answered.

With the start indicated, the children were well on their way toward gaining not only some of the facts and relationships of science, but also a way of solving real problems, and above all developing an attitude toward science. Most of us adults have learned our attitudes toward poetry, decimal fractions, or perhaps history from early experiences in school. The attitude learned may persist much longer than the facts with which it was associated.

The key role of science in our way of life makes the attitude of the public toward science of fundamental importance, and the public is largely the product of our elementary schools. The number and quality of persons entering science or one of the fields of applied science is closely related to the prestige of science and the willingness of the public to support research as a means of solving problems and developing opportunities. Once a scientist has chosen his field, public esteem or antagonism can either stimulate or repress his efforts. The results of research to be fully effective must have a sympathetic, open-minded public if the knowledge gained is to function. Giordano Bruno was burned at the stake for insisting the sky is infinite, not a rounded dome overhead, and Galileo was threatened with torture. More recently, the reaction to Darwin is well known, and within memory farmers have resisted the applications of science to agriculture. Many public issues today involve either the open-minded sympathy or the opposition of the public to science. In countless ways science impinges upon our daily living. That individuals react differently is due largely to the connotations that science has for them, their attitude toward it. Basic attitudes often are developed early in life.

After an incident which roused interest in the fire extinguisher in the hall, a sixth grade was talking, and one question led to another. The teacher helped to find reading references and also to locate or devise experiments that would aid in giving the insight desired. After reading and experimenting, the discussion eventually was resumed, each person now armed with facts he had found and experiments to show in making his explanations. One showed that a candle will not burn without air, another that a candle will not burn in carbon dioxide. That carbon dioxide can be detected with limewater was shown, and also that carbon dioxide is a product of combustion. One child demonstrated an extinguisher he had made from a milk bottle, baking soda, and vinegar. The reference work, experimenting, and discussing continued for several weeks until broad concepts of fire, heat, air, weather, and ventilation were developed. The active approach was productive of knowledge, but concurrently the planning, experimenting, demonstrating, and discussing developed an enthusiasm for science. In this case the work began with an incident, but in other cases may be stimulated by the teacher. But if good attitudes are to be developed, the teacher must not persist with plans where the children fail to respond.

Probably everyone in contact with children is aware of their restless curiosity, a spirit which also motivates the investigations of scientists. If the program is flexible enough to make use of these natural impulses, the attitude developed is good. Children should have opportunity to investigate, to work out their own ideas, guided, stimulated, and assisted by the teacher. If in the process something is discovered which others in the class—perhaps even the teacher—did not know, the child will be delighted with science. The development of a constructive attitude is not as elusive as it may seem. Direct experience with reality is stimulating. Where the teacher is responsive to the natural curiosity of children, they can work out their own ideas, observe with their own eyes, manipulate with their own hands, and then without excessive formality can tell others what they have found.

Some of the third graders were gathered about a sink half filled with water. A cork floated in the water. Someone said it floated because it was small, and the others agreed. But a rock equally small sank. So Tim said it doesn't matter what size, but the amount of water is important. The process continued, and eventually the children clarified their concept in a way no amount of reading and discussion alone would have achieved, yet even more vital was the attitude developed. All the facts a group of small children can master in a year may be learned far more rapidly by an adult, but the attitude will not be the same.

Good attitudes can result where the teacher too enjoys learning something new, is not afraid to depart a bit from the beaten path to explore along the side. The teacher's own enthusiasm is contagious.

NSTA Activities

More About Boston Dec. 27-30

A most attractive program is shaping up for the December meeting of NSTA and other AAAS Science Teaching Societies. To be held December 27-30 at the Bradford Hotel in Boston, the meeting will serve as the second in NSTA's 1953-54 program of regional conferences. Dr. John G. Read, NSTA representative on the general planning committee and in charge of individual sessions of NSTA, has submitted the following structural outline of the meeting. Details such as the names of speakers and other participants will appear in the next issue of *TST*.

Sunday, December 27

MORNING and AFTERNOON: Symposia planned and conducted by the AAAS Cooperative Committee on the Teaching of Science and Mathematics

EVENING: Joint buffet supper and mixer

Monday, December 28

MORNING: Joint film showing and joint session of Science Teaching Societies

AFTERNOON: NSTA Elementary Science Session, "Helping Teachers Move on to the Next Step in Teaching Elementary Science"; NSTA Secondary Science Session, "What Does an Effective Science Teacher *Do?*"

EVENING: AAAS Presidential Address

Tuesday, December 29

MORNING: Joint film showing and joint session of Science Teaching Societies

AFTERNOON: NSTA "Here's How I Do It" Sessions, (a) Elementary, (b) Secondary

EVENING: Junior Scientists Assembly; Biologists' Smoker

Wednesday, December 30

MORNING: "Reports From Inside NSTA—Policies and Goals, Research and Report of Facilities for Science Instruction, Services and Materials for Elementary Teachers, Business-Industry Relations, Future Scientists of America Foundation"

NSTA's participation in the joint meeting ends at noon on Wednesday. This will provide increased opportunity for attendants to take in some of the AAAS symposia or to attend the very large array of exhibits annually provided by AAAS. Since this annual meeting attracts a large crowd, it is advisable to make hotel reservations early. Write to: AAAS Housing Bureau, Room 614—80 Federal Street, Boston, Massachusetts. Application forms for reservations may be found in all recent issues of *The Scientific Monthly*.

And Then Chicago Next April 1, 2, 3

The planning committee for the Second National Convention of NSTA has been "pouring it on" even during the summer months. The committee has held two planning sessions and individual members of the various committees have been carrying on with their assigned chores. The result to date may be summed up briefly as follows:

Three general sessions with speakers of interest to everyone. Two speakers already "signed up" are Dr. Harlan Hatcher, President of the University of Michigan, and Mrs. Agnes Meyer of Washington, D. C. (*Washington Post*).

Two sessions at which there will be parallel symposia or science teaching clinics.

One session at which six to eight top scientists will report on "Recent Developments and Applications in Science."

Thirty-five to forty exhibits of textbooks, laboratory supplies and equipment, and other teaching aids for science.

A banquet session with a science demonstration and a scientist, Dr. Detlev Bronk, President of the National Academy of Sciences, as speaker.

A business-industry sponsored evening session followed by a mixer and social hour.

Two parallel "Here's How I Do It" sessions, one for elementary and one for secondary, with the possibility of increasing the number of sessions if the response justifies it.

Showings of science teaching films excerpted by the NSTA Motion Picture Committee.

A luncheon session at which Illinois science teachers and their organizations will be hosts.

AND—there will be twenty-one work-discussion groups to provide ample opportunity for *everyone* to take an active part in the convention deliberations. Subject to more or less modification, the questions for the discussion groups are as follows:

1. How can we plan effectively for a K-12 program in science?

2. How can we initiate an organized elementary science program?

3. How can we go about locating and using community resources in elementary science?

4. What science interests do elementary school children have and how can these interests be determined?

5. What curriculum helps and teaching aids should the elementary teacher have?

6. What training in science do elementary teachers want and what science should be included in the fifth year program for elementary teachers?

7. What internal changes in course content are called for by recent developments and applications in the various fields of science?

8. What are the next steps in curriculum development for general education background in science at the high school level?

9. What are the next steps in providing improved opportunities for student concentration in science at the high school level?

10. How is TV being used in science education and what seems to be ahead in this field?

11. What is the place of health education in the curriculum and how can we most effectively provide for it?

12. How can science supervisors, coordinators, consultants, and department heads work more effectively toward the improvement of instruction in state and large-city school systems?

13. How can science supervisors, coordinators, consultants, and department heads work more effectively toward the improvement of instruction in smaller school systems?

14. How can administrative personnel and science teachers work together more closely in improving curriculum and instruction in science in the total school program?

15. What should NSTA recommend in terms of minimum certification requirements for science teachers?

16. How shall we deal with the growing curtain of secrecy in science and with restrictions on academic freedom?

17. What are the critical issues in science education today?

18. What are the next steps in strengthening science instruction through relations with non-school groups?

19. What are the next steps in improving services offered to science teachers through their professional journals?

20. What are the problems and respective responsibilities of high schools and colleges in securing improved articulation in science?

21. How can we secure increased motivation in science through participation in extra-class activities and better

coordination of these activities with the science curriculum?

Outstanding and nationally known leaders are now being secured to serve as chairmen of these discussion groups. The committee desires to make absolutely certain that these discussions will be realistic and practical. To this end, it is felt that active participation by classroom teachers and others who "live" with these problems day in and day out is absolutely essential. The Executive Secretary's office has been assigned the task of compiling a roster of all such persons who are willing and available to serve as consultants in the various work-discussion groups. *This is your invitation to volunteer.* Don't put it off; the sooner you write, the better—even though you may have to make your commitment tentative. If NSTA can be of any help to you in obtaining released time to attend the convention without loss of pay, and perhaps with full or partial reimbursement of expenses by your school system or institution, please let us know and we shall be glad to cooperate.

Much of the "pouring it on" to assure a smooth-running convention has been and will be done by local committees. Heading the committees on local arrangements is Antone A. Geisert, Assistant Director, Division of Visual Education, Chicago Public Schools. He is being assisted by the following committee chairmen: *Meeting Rooms and Facilities,* Clyde W. DeWalt, Glenbard Township High School; *Hospitality,* Ruby Freemont, Calumet High School; *Registration,* Theodore W. Wallschlager, John Palmer School; *Tours and Transportation,* John Maier, St. Michael Central High School; *Commercial Exhibits,* Edward C. Schwachtgen, Chicago Board of Education; *Instructional Exhibits,* Reynolds A. Hungerford, Chicago Board of Education; *Publicity,* James Irving, Scientific Apparatus Makers Association; *Productions,* Emilie U. Lepthien, Chicago Board of Education; *Signs and Posters,* H. Harris Fowler, Chicago Vocational High School; *Banquet,* Nelly J. Bosma, Wright Junior College; *Audio-Visual,* Ira J. Peskind, Wright Junior College; *Promotion,* Matthew L. Fitzgerald, Superintendent of High School District 2, Chicago Public Schools.

1953-54 Committees Announced by President Grant

Following consultation with other members of the Board of Directors through correspondence and at the Miami Beach meeting, President Charlotte L. Grant has announced that with minor exceptions, the roster of NSTA committees for the current year is complete. The various committees and their membership are as follows. Where terms of members differ from the NSTA fiscal year or extend beyond the current year, dates of expiration of appointments are indicated in parentheses.

Standing Committees

Audit—*Chairman,* John S. Richardson, Ohio State University, Columbus
Elra M. Palmer, Baltimore, Md., City Public Schools
Mrs. Marjorie H. Campbell, Washington, D. C., Public Schools

Budget—*Chairman,* John S. Richardson, Treasurer of NSTA, Ohio State University, Columbus
Walter S. Lapp, President-Elect of NSTA, Overbrook High School, Philadelphia, Pa.
Philip G. Johnson, Chairman of FSAF, Cornell University, Ithaca, N. Y.
M. Edmund Speare, Chairman B-I Section, Bituminous Coal Institute, Washington, D. C.
Robert H. Carleton, Executive Secretary of NSTA, Washington, D. C.
Glenn O. Blough, representing NSTA membership at large, U. S. Office of Education, Washington, D. C.

Membership—*Chairman,* Martin Thames, Bemidji, Minn., High School
Greta Oppe, Ball High School, Galveston, Texas
Elra M. Palmer, Baltimore, Md., City Public Schools
Dean Stroud, Amos Hiatt Junior High School, Des Moines, Iowa
Stanley E. Williamson, Oregon State College, Corvallis

Nominations—*Chairman,* Richard H. Lape, Amherst Central High School, Snyder, N. Y.
Gladys V. Benner, Board of Education, Philadelphia, Pa.
Helen E. Hale, Baltimore, Md., County Public Schools
Hubert Evans, Teachers College, Columbia University, New York City
Nathan A. Neal, McGraw-Hill Book Company, New York City

Program—Rocky Mountain Regional Conference (Oct. 8-10)—*Chairman,* Stanley B. Brown, University of Colorado, Boulder
Harold Anderson, University of Colorado, Boulder
S. Sam Blanc, East High School, Denver, Colo.
Donald Decker, Colorado State College of Education, Greeley
Mrs. Margaret Juchem, State Department of Education, Denver
William Walsh, University of Colorado, Boulder
Paul Wilkinson, Manual High School, Denver, Colo.

Boston Regional Conference (AAAS) (Dec. 27-30)—*Chairman,* John G. Read, Boston University
Arthur Burroughs, Arlington, Mass., Junior High School
Eleanor Johnson, Weeks Junior High School, Newton, Mass.
Robert D. MacCurdy, Watertown, Mass., Senior High School
Lester C. Mills, High School, Beverly, Mass.
Charles Howard, Weeks Junior High School, Newton, Mass.
William Winston, Newton, Mass., School Department

Second National Convention, Chicago (April 1-3) —*Chairman,* Ralph W. Lefler, Purdue University, Lafayette, Ind.

Robert H. Cooper, Ball State Teachers College, Muncie, Ind.

Antone A. Geisert, Chicago Public Schools

Allen F. Meyer, MacKenzie High School, Detroit, Mich.

John S. Richardson, Ohio State University, Columbus

Brother Fred T. Weisbruch, Don Bosco High School, Milwaukee, Wis.

New York City Regional Conference (NEA) (June 26-28)—*Chairman,* Hubert M. Evans, Teachers College, Columbia University, New York City

Professional Relations and Projects—*Chairman,* Stanley E. Williamson, Oregon State College, Corvallis

Stanley B. Brown, University of Colorado, Boulder

Kenneth E. Anderson, University of Kansas, Lawrence

Charles F. Beck, Pittsburgh, Pa.

Charlotte V. Meeting, McGraw-Hill Book Company, New York City

Public Relations—*Chairman,* Charlotte L. Grant, President of NSTA, Oak Park and River Forest High School, Oak Park, Ill.

Robert H. Carleton, Executive Secretary of NSTA, Washington, D. C.

Walter S. Lapp, President-Elect of NSTA, Overbrook High School, Philadelphia, Pa.

Resolutions—*Chairman,* Zachariah Subarsky, Secretary of NSTA, Bronx High School of Science, New York City

Special Committees

AAAS Cooperative Committee—*Representative,* Morris Meister, Bronx High School of Science, New York City

AAAS Council—*Representative,* Zachariah Subarsky, Bronx High School of Science, New York City

Administrative Committee, Future Scientists of America Foundation—*Chairman,* Philip G. Johnson (Aug. 1, 1953), Cornell University, Ithaca, N. Y.

Henry H. Armsby (Aug. 1, 1954), U. S. Office of Education, Washington, D. C.

Allen V. Astin (Aug. 1, 1954), National Bureau of Standards, Washington, D. C.

Robert H. Carleton, National Science Teachers Association, Washington, D. C.

Charlotte L. Grant (Aug. 1, 1954), Oak Park and River Forest High School, Oak Park, Ill.

Walter S. Lapp (Aug. 1, 1955), Overbrook High School, Philadelphia, Pa.

Milton O. Lee (Aug. 1, 1955), Federation of American Societies for Experimental Biology, Washington, D. C.

Ralph W. Lefler (Aug. 1, 1955), Purdue University, Lafayette, Ind.

John S. Richardson (Aug. 1, 1954), Ohio State University, Columbus

Advisory Council on Industry-Science Teaching Relations—*Chairman,* John S. Richardson (1956), Ohio State University, Columbus

Science Teaching Members

Lydia Elzey (Feb. 1, 1954), Pennsylvania State College, State College, Pa.

Kenneth E. Vordenberg (Feb. 1, 1954), Cincinnati, Ohio, Public Schools

Elbert C. Weaver (Feb. 1, 1954), Phillips Academy, Andover, Mass.

Charlotte L. Grant (Aug. 1, 1954), Oak Park and River Forest High School, Oak Park, Ill.

Richard H. Lape (Feb. 1, 1955), Amherst Central High School, Snyder, N. Y.

Ralph W. Lefler (Feb. 1, 1955), Purdue University, Lafayette, Ind.

Walter S. Lapp (Aug. 1, 1955), Overbrook High School, Philadelphia, Pa.

Morris Meister (Feb. 1, 1956), Bronx High School of Science, New York City

John H. Woodburn (Feb. 1, 1956), Illinois State Normal University, Normal, Ill.

Industry Members

John Burger, General Mills, Inc., Minneapolis, Minn.

Lawrence G. Cooney, Pittsburgh Plate Glass Company, Pittsburgh, Pa.

Margaret Delaney, American Institute of Baking, Chicago, Ill.

Alma Deane Fuller, American Forest Products Industries, Washington, D. C.

Gilbert P. O'Connell, General Motors Corporation, Detroit, Mich.

H. Vinton Potter, American Gas Association, New York City

Ernest H. Reed, International Harvester Company, Chicago, Ill.

Reginald G. Sloane, Standard Oil Company (N. J.), New York City

M. Edmund Speare, Bituminous Coal Institute, Washington, D. C.

Louis M. Stark, Westinghouse Electric Corporation, Pittsburgh, Pa.

Affiliated Groups—*Chairman,* Gertrude W. Cavins, San Jose State College, San Jose, Calif.

Maitland P. Simmons, Irvington High School, Irvington, N. J.

G. Davis Chase, Senior High School, New Britain, Conn.

Robert Molkenbur, Central High School, St. Paul, Minn.

Apparatus and Equipment—*Chairman,* Hugh E. Brown, W. M. Welch Manufacturing Co., Chicago, Ill.

Dwight L. Barr, High School, River Grove, Ill.

John Cralley, Carmi Township High School, Carmi, Ill.

Ralph H. Dillon, Oskaloosa, Iowa, High School
Norman R. D. Jones, Southwest High School, St. Louis, Mo.
Richard M. Sutton, Haverford College, Haverford, Pa.
Bernard Toan, Millburn High School, Millburn, N. J.
Elbert C. Weaver, Phillips Academy, Andover, Mass.

Conservation—*Chairman,* F. Olin Capps, Missouri Conservation Commission, Jefferson City, Mo.
Norman R. D. Jones, Southwest High School, St. Louis, Mo.
Dorothy V. Phipps, Chicago Teachers College
Howard Owens, Northwestern High School, Hyattsville, Md.
Ralph K. Watkins, University of Missouri, Columbia, Mo.

Elementary School Science—*Chairman,* Glenn O. Blough, U. S. Office of Education, Washington, D. C.
N. Eldred Bingham, University of Florida, Gainesville
Donald G. Decker, Colorado State College of Education, Greeley
Hildegarde Hartig, San Diego County, Calif., Schools
Clark Hubler, Wheelock College, Boston, Mass.
James G. Lawrence, Granite School District, Salt Lake City, Utah
Grace C. Maddux, Cleveland, Ohio, Public Schools
George G. Mallinson, Western Michigan College of Education, Kalamazoo
Albert Piltz, University of Florida, Gainesville
Robert Stollberg, San Francisco State College

Evaluation of Sponsored Teaching Aids—The membership of this committee, numbering well over 100 persons, will be published in a later issue of *The Science Teacher.*

Health Science—*Chairman,* Mrs. M. Gordon Brown, Atlanta, Ga., Public Schools
Katherine Hertzka, Atlanta, Ga., Public Schools
Thomas H. Knepp, High School, Stroudsburg, Pa.
David McNeely, Summit, N. J., High School
Betty Lockwood Wheeler, Mount Pleasant, Mich.

International Relations—*Chairman,* Blanche Bobbitt, Board of Education, San Francisco, Calif.
W. Bayard Buckham, Oakland, Calif., High School
Mildred B. Forbes, Bay City, Mich., High School
Ellsworth S. Obourn, John Burroughs School, Clayton, Mo.

Magazine Advisory Board—*Chairman,* Miss Archie J. MacLean (Dec. 31, 1955), Board of Education, San Francisco, Calif.
Marjorie H. Campbell (Dec. 31, 1954), Washington, D. C., Public Schools
Charlotte L. Grant (Dec. 31, 1954), Oak Park and River Forest High School, Oak Park, Ill.
Morris Meister (Dec. 31, 1953), Bronx High School of Science, New York City
Louis Panush (Dec. 31, 1955), Northeastern High School, Detroit, Mich.
Hanor A. Webb (Dec. 31, 1953), Nashville, Tenn.

Motion Picture Committee—*Chairman,* J. Darrell Barnard, New York University, New York City
N. Eldred Bingham, University of Florida, Gainesville
Hubert M. Evans, Teachers College, Columbia University, New York City
John G. Read, Boston University

Policies Committee—*Chairman,* James G. Harlow, University of Oklahoma, Norman
Glenn O. Blough, U. S. Office of Education, Washington, D. C.
William F. Goins, Jr., Tennessee A. and I. University, Nashville
Milton O. Pella, University High School, University of Wisconsin, Madison
S. Ralph Powers (retired), Teachers College, Columbia University, New York City
Henry Shannon, State Department of Education, Raleigh, N. C.

Publications—*Chairman,* Abraham Raskin, Hunter College, New York City
Paul Brandwein, Forest Hills, N. Y., High School
James B. Davis, Lower Merion Township School District, Ardmore, Pa.
Brenda Lansdown, Brooklyn College, New York
S. Ralph Powers (retired), Teachers College, Columbia University, New York City
Harry H. Williams, Horace Mann School, New York City

Chicago Scientific Careers Committee—*Representative,* Hugh E. Brown, W. M. Welch Manufacturing Co., Chicago, Ill.

Standards for the Certification of Science Teachers—*Chairman,* Ira C. Davis, University of Wisconsin, Madison
Fletcher C. Watson, Harvard University, Cambridge, Mass.
J. Darrell Barnard, New York University, New York City
Robert Stollberg, San Francisco State College

Ex Officio on all Committees—Charlotte L. Grant, President of NSTA, Oak Park and River Forest High School, Oak Park, Ill., and Robert H. Carleton, Executive Secretary of NSTA, National Education Association, Washington, D. C.

Two brief explanations are perhaps in order: (1) a number of names are repeated because of requirements established by the Board of Directors that certain officers and directors hold membership on certain committees; (2) a greater effort has been made this year than ever before to develop certain committees on a geographical basis so that the committee may find it possible to meet in person during the year at little or no cost to the Association. The latter item is somewhat in the nature of a "trial run" and comments and suggestions by members are welcome.

FSA Activities

Science Achievement Awards

Program for 1953-54

Now is a good time to request copies of the Rules Book and Entry Forms for the 1954 Science Achievement Awards Contest.

This awards program has several features that make it especially attractive. Many science teachers have been confronted with the situation in which groups of their students have completed worthwhile projects but no opportunity was available to give the students the recognition they deserved. The Foundation is gratified to have the American Society for Metals make such an opportunity available, especially so since it extends from the seventh through the twelfth grades.

This program also recognizes the role of the good teacher who is creative not only in his or her own work but also encourages activity learning in routine class procedure. The awards to teachers are small in cash value. The total science education profession, however, can well appreciate the values that accrue from making available to all teachers the reports of "best practices and most effective techniques" that are submitted in connection with the teacher phase of the program.

Inquiries regarding FSAF activities and publications may be addressed to the Future Scientists of America Foundation, NSTA, 1201 16th St., N. W., Washington 6, D. C.

Encouraging Future Scientists:

The Situation

Do you want the word on the participation of our nation's schools in the existent science and engineering incentive and guidance programs? Copies of *Encouraging Future Scientists: The Situation* are now being distributed from the NSTA headquarters. There is no charge for single copies.

This report deals with the problems associated with participation in incentive and guidance programs that are directed toward high school youth who are in position to consider careers in science or engineering. In compiling the report, 425 teachers provided facts and opinions growing out of their experiences with such programs. Their schools are located in 42 states and enroll some 326,000 boys and girls.

Evidence indicates that the 425 respondees do not represent a true sample of the nation's schools. The average size of the schools in the sample is well above the national average. There is nearly one full-time guidance person per school whereas, on a nation-wide basis, there is scarcely one such person to every three schools. These teachers estimate their schools' holding power to be about ten per cent above the national estimate. Their estimate of the per cent of their graduates going on to college agrees rather closely, however, with the U. S. Office of Education's estimate of the national situation.

According to these teachers, a typical four-year high school offers general science in the ninth grade (87 per cent do), biology in the tenth (98 per cent), chemistry (94 per cent) and/or physics (93 per cent) in the eleventh and/or twelfth. The extent of science offerings in these schools is definitely higher than the nation-wide average. These facts leave the impression that our respondee sample may be definitely over-loaded with schools in which the science programs, in general, are better nurtured than in the typical school. Although this will have to be kept in mind as one interprets the data in *Encouraging Future Scientists: The Situation*, there can be little doubt that much can be done to increase the effectiveness of the incentive and guidance programs that are directed toward high school boys and girls.

Encouraging Future Scientists:

Available Materials and Services

This report promises to be a very comprehensive list of incentive programs and guidance materials that are designed for junior and senior high school youth.

Each day's mail brings additional returns of the inventory form that we sent last month to over 800 industries and agencies that sponsor science and engineering programs and guidance materials. If the number of respondees doesn't go too far above our expectations, we promise to have the report compiled by Christmas.

Within the teacher inventory forms that were returned there was a strong demand for such a publication. We invite all teachers to send additional descriptions of such programs in case our coverage with the inventory form was inadequate.

Copies of *Encouraging Future Scientists:* Available materials and services, when available, will be sent to all of our respondees and to others by request. It will probably be necessary to charge for this publication.

▶ *Summer Jobs* For Teachers

What will you be doing next summer? Would you like to work in some science-related industry or government activity? In their responses to our inventory of teachers' opinions and experiences with sponsored incentive programs and guidance services, the teachers clearly identified on-the-job experiences in science-related laboratories and factories as the number one source of teacher incentive.

Several industries have reported their willingness to go along with this kind of program. For these reasons, the Foundation may launch a national campaign to encourage more industrial and public organizations to provide summer jobs for science teachers. However, before we do this we want some information and your opinions.

Are there many teachers who want and can't find summer jobs in science-related activities?

Will teachers leave their local communities to take such jobs?

Would such a program be in opposition to the summer offerings of our colleges and universities?

Your answers to these questions and your reactions to the whole idea will be very useful to those of us who have to make the decisions.

▶ *Chart Making Contest*

For Science Students

Do you have students in your classes whose creative abilities just don't seem to fit into the usual project activity? Do these boys and girls like to make charts that clarify or drive home some scientific fact, application, principle, or technique? If so, you will be interested in a brand new contest being sponsored by the W. M. Welch Scientific Company. Thirteen cash and Series E Savings Bonds are being offered as incentives. The entries must be received by March 1. We will be glad to provide the details and entry forms for all who may be interested. Incidentally, the final judging will be done by the teachers who attend the National Convention of the NSTA in Chicago next spring.

Future Scientists of America Foundation, NSTA, 1201 16th St. NW, Washington 6, D.C.

Science teachers all over America will be represented on DuPont's TV Cavalcade of America on October 27. The ABC network program will portray the work of a typical high school science teacher. For this role, the NSTA was glad to be able to nominate one of its members, Mr. R. J. Gladieux, of Kenmore, New York. Consult your local paper for the time of showing in your area and suggest to your students that they compare you as a teacher with Mr. Gladieux.

Book Reviews

EVERYDAY PHYSICS, Nelson and Winans, 614 pp. $4.36. Ginn and Company. Boston. 1952.

It is always refreshing to discover a high school text with a new approach. The authors of *Everyday Physics* have succeeded in presenting the fundamental principles of physics through the home and other aspects of the students' immediate environment. It follows that the organization of such a text must depart from the traditional sequence of mechanics, heat, light, sound, and electricity. After a stimulating introduction called "What is Physics?", the book has the following units: The Home; Heat for Comfort; The Age of Electricity; Heat in the Kitchen; Light and Vision; Science and Recreation; Communication; Less-Known Scientific Developments; Motor Transportation; and Air Transportation.

A breakdown of Unit III, the Age of Electricity, will give an idea of topics covered and how principles are presented. The unit is introduced with a list of electrical appliances used in the home. In the discussion of the functioning of these appliances, electrical units, Ohm's Law, the measurement and cost of electrical energy, generation, transmission, and the electron theory of electricity are covered both descriptively and by quantitative measurements. The vacuum cleaner, washing machine, and refrigerator are discussed in detail as applications of most electrical and mechanical principles.

Study helps are varied and stimulating. A complete index, a glossary, bibliography, and physical tables are in the appendix. The "Things to Do" lists at the close of each chapter offer to the students (and teachers!) unlimited possibilities for experimentation and further investigation. The diagrams are simple and clear. Some colored illustrations might have added to the appeal of the book.

The mathematics used is very simple, the authors apparently believing that problem solving does not necessarily involve mathematics beyond arithmetic and the simplest formulas. Critical and systematic thinking is stressed by the interjection of challenging questions.

Teaching with the aid of this text will be a welcome change to those teachers who wish to depart from a "cut and dried" presentation and who wish to appeal to the student through his interests and in the area of his daily living.

M. M. HASSE
Central High School
Aberdeen, South Dakota

EARTH SCIENCE. Gustav L. Fletcher and Caleb W. Wolfe, Third Edition. 556 pages. $3.60. D. C. Heath and Company, Boston. 1953.

Geography is not generally taught in the American high schools, the Association of American Geographers reported recently (*New York Times*, Aug. 30, 1953). The Association went on record calling for more emphasis on the subject. To which we agree, for in these days of confusion, it is important that the high school student becomes acquainted with the geography of our country and the world of which we are a part. And a good text to use to sharpen the student's perspective in physical geography or earth science courses is Fletcher and Wolfe's "Earth Science."

The text, as the authors put it, is organized to fit a sequence of topics. The first eighteen chapters deal with the land; the next four examine the earth in space, followed by six chapters covering the subject of the atmosphere. Next are two chapters devoted to weather and climate, followed by three that are concerned with the sea and its work. Bringing up the rear as the final chapter is an excellent discussion on the conservation of our resources, a topic that needs much airing these days.

Each chapter is concluded with a set of summary fill-ins, and exercises. There is an appendix that covers maps and map projections, general review questions and a list of reference books for further reading. The text is printed in two type sizes: the larger for a minimum course while the smaller type (also labelled with a star) may be used for the faster pupils. To this reviewer, the use of the star system to differentiate the material and the students is not very sound. Otherwise, the book is an altogether good one that should prove desirable for its intended uses.

LOUIS TRUNCELLITO
Memorial High School
West New York, N. J.

THE TREE ON THE ROAD TO TURNTOWN. Glenn O. Blough. 48 pp. $2.00. McGraw-Hill Book Company, Inc. New York. 1953.

This book presents an interesting story of relationships between plants, animals, and man. As the story of the Great Oak unfolds, important concepts are introduced in an impressive way. Among them are included the germination of the acorn, the growth of the tree, the passing of the seasons, the friends and enemies of the oak, and the needs of the tree. These are described in a vivid and accurate manner. Finally, the Great Oak is sold and cut into logs and boards. The many uses of the tree are enumerated. Thus the story ends with emphasis on the wise use of a natural resource. A short review is also given of the factors which contributed to the tree's existence. The book is a delightful one which will be read chiefly by children in the nine-to-twelve age group. These children will enjoy the story as well as the beautiful illustrations which were drawn by Jeanne Bendick. This book will be a welcomed addition to the science classroom or to a school library.

FLORENCE E. LEARZAF
Pittsburgh Public Schools
Pittsburgh, Pennsylvania

PHOTOGRAPHY WORKBOOK. Victor C. Smith. 85 pp. $.90 to schools. J. B. Lippincott Company, New York. 1953.

Here is an entirely new workbook, the first of its kind, which will be of great assistance to teachers who now have classes in photography or plan to teach photography soon. It is designed to guide the student through a course which will teach him the "art of taking pictures and the science of developing and making them."

In the words of the author this workbook provides:

1. Systematic and properly graded learning experiences
2. Laboratory and darkroom directions
3. A guide to reading references
4. A large amount of briefly stated, precise information
5. Novel learning exercises and self-tests
6. Many aids for the teacher in planning classwork

The book contains 38 two-page lessons which direct the pupil's activities in taking pictures, developing film, printing and mounting pictures, and the use of reference books and magazines. Great emphasis is placed on cleanliness, neatness, quality of work, and making pictures with a purpose. It gives the experienced teacher many new ideas and methods and the new teacher an entire course which has worked well for the author.

MAHLON H. BUELL
Senior High School
Ann Arbor, Michigan

MAN AND THE LIVING WORLD. E. E. Stanford. 835 pages. $5.50. The Macmillan Company, New York. Second edition, 1951.

This is a textbook for students in college general biology and advanced high school biology. Mr. Stanford has done an excellent job in emphasizing simplicity and generality. The text is written in an interesting manner and would compel the reader to peruse, without assignment from the instructor, other sections of the book.

There is such a large organization of material that the book must be treated as a lecture aid. While the writer expects the entire material to be covered in one year, this volume is so extensive that it would be an impossibility. There is a lack of questions to be answered and a summary at the end of each chapter. The 26-page index is designed to compensate for the lack of an appendix.

The author takes a middle of the road course in regard to the correlation of biology and social problems. As an example, in the chapter on the reproductive system his analysis of the Kinsey Report states that this statistical study is both good and bad, when most authorities have found the paper to be deceptive and in many cases unreliable. As in many biology books of today, the reproductive system, one of our most compelling and challenging problems, is treated with a mere 12-page explanation.

High school general science and biology teachers would find this excellent material for their bookshelves, as it answers some of the general questions that usually arise in the course of the school year in not too technical terms. Such questions as which cow yields the greatest amount of milk or butterfat, or which chicken is the best producer, are answered in the chapter on domestic animals. These would ordinarily have to be found in an agricultural publication. The material on atomic energy and narcotics, while being quite short, is refreshing and presented so the student can understand easily.

PAUL H. BUCKLEY
Peters High School
Southborough, Mass.

BOECK—continued from page 237

assignments were concerned with the study of the preparation of sulfur trioxide and sulfuric acid.

This type of teaching provides opportunity for types of student activity not usually called for in laboratory manual experiments and question-answer recitation. (1) Each pupil is expected to make his contribution of the sort and to the extent of his abilities. The numbers of planners and conclusion-drawers are of course greatly exceeded by the number of data collectors but (2) all pupils are expected and given opportunity to produce some results acting as all three independently and collectively. This kind of class work also provides for (3) learning good experimental technique such as provision for adequate controls and replication as well as the usual compliment of manipulative laboratory skills. Throughout the planning stages (4) a constant review is provided, a review with purpose, because pupils look to previously studied materials and learned facts and relationships to provide the basis for solving the problem at hand. Opportunity is also provided (5) for the evaluation of pupil abilities and work products involving more than the memorization of factual materials. The pupils find the instruction (6) interest sustaining, stimulating, and satisfying.

BERRONG—continued from page 241

devote to this above need. THAT'S YOUR JOB!

But then, since you are college, and I am fifth grade, I didn't expect you to listen. NOT REALLY!

P.S. Just in case you did listen and have come this far, here are three pointers:

1. Your AIM: A basic understanding of and a lasting interest in each topic.
2. Keep your vocabulary SIMPLE!
3. Nothing takes the place of real EXPERIENCE. (A minimum of lecturing!)

READERS—continued from page 216

dicated. The group numbers correspond with the "positive valency" of the elements in each group. The symbol 0 is chosen for the helium group because they have zero valency. Gases and typical non-metals are together. The entire table is a "chemical tool."

The Periodic Table is a summary of related facts regarding the properties of the elements. As such, it must be based on the facts of experiment and experience, and not on the results of theoretical study.

KEITH S. DARLING
Dimboola Memorial High School
Victoria, Australia

I was interested in seeing Prof. Darling's criticism of my article and shall try to clear up some misunderstandings that may have been caused by too great a condensation of my original paper.

I do not feel that I have "forgotten the * * * similarity of properties" because I placed helium in the alkaline-earth family. Other workers such as Luder and Babor have done the same. In my original paper, I gave hydrogen and helium alternate positions in Period 2 beside lithium and placed sodium and magnesium in alternate positions beside aluminum. For the sake of brevity, I omitted this in my condensation but if Prof. Darling will insert these elements as described he will find that they fit nicely, thus showing the relationship of hydrogen to the other monovalent gases, helium to the inert gases, sodium to the monovalent noble metals, and magnesium to zinc. Aside from helium, my table contains the same groups arranged in the same order as most other examples of the "long form."

I might remind Prof. Darling that the original Mendelejeff Table, which served scientists so well for many years, places gold and cesium in the same group and the same can be said for fluorine and manganese.

Prof. Darling feels that my table "belittles the question of valency." Perhaps it would be better to say that I ignored it. Since only helium had been shifted, I saw no need to repeat what has already been said so many times. It seems to be pretty well agreed today that no periodic table can be more than a help as far as valence is concerned.

My rule about "two periods of each length" is not "arbitrary," it is mathematical. Mathematical regularity requires two periods of two elements each. If Prof. Darling will refer to a letter by Reino W. Hakala in the November (1952) issue of the *Journal of Chemical Education,* he will find this matter considered in some detail. Various suggestions have been made for providing the second period of two, such as classifying the neutron and alpha particle as elements or postulating two new elements, "coronium and nebulium." All I did in making my table is to use the next two elements, lithium and berylium, and then the rest of the table worked out beautifully. The remaining elements fell into the correct groups; the actinides fell under the lanthanides.

Concerning the criticism of my Point 6, (not Point 7, as indicated in the letter) that I am guilty of "loose writing" when I say that "The Table proves * * * that the transradium elements constitute a new series of rare earths," I stand corrected. The table alone will not prove the case. I should have used the words "is proof that." Prof. Darling should know that, in the scientific method, any theory is based on "the facts of experiment and experience." As he says, "The entire table is a 'chemical tool'." It is not a scientific fact but an invention of the scientist. That table which best shows the facts and is of most use to the scientist is the best one.

I should be much interested in seeing a copy of the table Prof. Darling uses. His description leaves the reader with the impression that my table is a freak, whereas actually it agrees with his description in every detail except one which is impossible. He states that "The group numbers correspond with the 'positive valency' of the elements in each group." Now there are thirty-two groups in the periodic table but it is well known that valence does not run that high.

We remember how Newlands was ridiculed when he presented *his* ideas about the periodic system. It is human nature to dislike change and new ideas. It took me several years to satisfy myself about the innovations in my table, but I now submit that they are correct.

OWENS HAND BROWNE
St. Mary's School and Junior College
Raleigh, North Carolina

ASHBY—continued from page 224

to exercise control over our schools and colleges are dangerous enough.

Far worse is the effect of these attacks on the integrity of education itself. There exists in our schools and colleges today, as a result of these attacks, a self-censorship which, if we knew its extent, would be far more frightening than the few communists who may be in the teaching profession.

While most of the pressure at present is felt in the field of the social science, where textbooks have been especially under attack, is there any reason to assume that the natural sciences, too, cannot be affected?

One of the reasons Mr. Malenkov rose to the top in Russia, according to a recent *New York Times* story, was the fact that he and his followers supported the Lysenko theory that acquired characteristics developed by environment can be inherited. According to this novel theory, communist education could change inherited characteristics and create a new species of human being. The enemies of this theory led by Zhdanov were liquidated one way or another.

Harold Laski wrote a pamphlet in 1940 entitled *The Rights of Man* which pointed out the decline in freedom of education along with other phases of German life. He said: "The German student, in short, is being made the prisoner of a narrow and imposed tradition, conformity with which is the condition of a successful career. It is not, therefore, remarkable that careful observers report a decline in the standards of all German universities, even in the more technical subjects like medicine and the physical sciences."

The California Appeals Court, which declared unconstitutional the regents' action at the University of California, said: "While the court is mindful of the fact that the action of the regents was, at the outset, motivated by a desire to protect the university from the influence of subversive elements, dedicated to the overthrow of our constitutional government . . . we are also keenly aware that, equal to the danger of subversion without by means of force and violence, is the danger of subversion from within by the gradual whittling away and disintegration of the very pillars of our freedom."

In view of such evidence as has been presented, what should be done about the situation? I would like to suggest a platform for thoughtful Americans who are concerned about the future of their children's children and the freedom these youngsters will enjoy in all fields, including science.

First, we know that there is a real communist conspiracy. This attempt to destroy our freedoms must be met with vigor but also with intelligence.

Second, we need equal vigilance to nullify the efforts of all others to frustrate freedom. Subtly working, usually in the garb of patriotism, they may be equally as dangerous as any communist plot.

Third, we must stand for freedom in the market of ideas. The notion that sound American ideas and principles cannot hold their own in free debate must be exposed. We need today the spirit which Socrates exhibited, as Erwin Edman recently recalled in the *Atlantic Monthly,* as "the first martyr to the principle of freedom of thought and to thought itself, which he placed higher than private convenience, comfort, or reputation."

Fourth, we must stand firmly for the principle of local control of education. Our schools are in the control of the state and local school systems and must always be kept there. No central office now has any policy control over the schools of America. None must ever have. We are free to experiment, to try new ideas, to make mistakes in our educational program. We ought to measure every proposal seeking to restrict the freedom of education in the language which Jefferson used in a letter to prospective members of the faculty of the University of Virginia: "This institution will be based on the illimitable freedom of the human mind. For here we are not afraid of truth wherever it may lead, nor to tolerate error so long as reason is left free to combat it."

Fifth, we need to do a better job of helping the American people to understand the modern program of our schools and colleges. Some of the criticisms are based on misunderstandings. Half-truths are circulated and taken as gospel by those who simply do not know what our schools are doing. It is imperative that we keep the people informed if we are to maintain the freedom to learn and to teach.

Sixth, we must reverse the major focus of our attention in America. We have been trapped in this country and this period into directing our energies *against* something. We must regain the American tradition of being *for* something. Only thus can we be sure of the strength to win the long cold war that looms ahead.

Seventh, we must reverse the trend in the direction of restrictions on freedom. This battle must be fought on many fronts—the homes, in the schools, in the communities, in the state legislatures, in the Congress, in the churches, in the clubs, and in every forum in American life. It will not be easy. There are powerful groups whose motive

is to restrict freedom. They are afraid of new ideas. To them, freedom has become too dangerous to use. The actions of others, however well-intentioned, result in restrictions.

Eighth, we need to rekindle the revolutionary spirit in which our country was founded. We cannot move forward on the status quo. Those who sought independence for America did not fear change. They found it indispensable to their well-being.

Ninth, we must help the American people to understand that those who would restrict freedom and create fear and suspicion are not the true patriots. They are the reactionaries. Some of them are fascist in nature. Some of them are using communist techniques. The real patriots today are those who stand firmly for the freedom of the human spirit.

Tenth, we should stop whispering campaigns against individuals by bluntly challenging the peddlers of gossip and misinformation to put up with evidence or shut up. Let us insist upon facts and documentation.

Eleventh, we must learn to recognize that even minor restrictions upon the freedom to teach and to learn are dangerous. They are serious in and of themselves. They are more serious because one thing leads to another. The subtle creeping paralysis which fear and restriction have placed on the human mind is sometimes very difficult to recognize but failure to recognize it and to act against it is the most serious problem before the American people. If we are unable to offset the attacks now being made on the integrity of education, then freedom's top-soil will erode faster and faster until we find ourselves in the gutters of conformity.

We should seek to make of our schools what Rabindra Nath Tagore said in his verse:

> "Where the mind is without fear and the head is held high;
> Where knowledge is free;
> Where the world has not broken up in fragments into narrow domestic walls;
> Where words come out of the depths of truth;
> Where tireless striving stretches its arms toward perfection; . . . ."

Is the greatest thing in science in danger? There is no doubt about it. Any encroachment on our liberty is a threat to the scientific method.

These coupons announce the availability of free and low-cost teaching aids for science. Business-sponsored items have been reviewed by the NSTA Evaluation Committee and approved for distribution by the Association. To procure copies of desired items, fill out and clip the corresponding coupons and mail these, together with any remittance required, to the NSTA Executive Secretary, 1201 Sixteenth Street, N.W., Washington 6. Watch these columns for additional offerings in future issues of *The Science Teacher*. (Print or type coupons.)

THE A-B-C's OF ALUMINUM. *Reynolds Metals Company.* In simple non-technical language, this booklet tells the story of who discovered aluminum, what it is and what its properties are like, how it is made into useful products, etc. 32 pp.; free.

COMBATTING PREJUDICE THROUGH SCIENCE TEACHING. *National Science Teachers Association.*

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